LIGHTNING FIRES IN NORTHERN ROCKY MOUNTAIN FORESTS

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NOTICE

This is the Final Report for Cooperative Agreement 16-440-CA between the Intermountain Forest and Range Experiment Station and the Department of Forest and Wood Sciences, Colorado State University. The contents of this report are the sole responsibility of the authors.

This report covers lightning-caused fires only. Man-caused fire records are currently being analyzed and will be combined with the lightning fire data to produce a total fire risk for the Northern Rocky Mountain area.

Information, questions, or comments relating to this report should be directed to:

Donald M. Fuquay
Northern Forest Fire Laboratory
Drawer G
Missoula, MT 59807
Phone: FTS 585-3493
406-329-3493

LIGHTNING FIRES IN NORTHERN ROCKY MOUNTAIN FORESTS[1]

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Jack S. Barrows, David V. Sandberg and Joel D. Hart[2]

Department of Forest and Wood Sciences
College of Forestry and Natural Resources
Colorado State University
Fort Collins, Colorado

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(2) Barrows is a faculty member; Sandberg, a former faculty member; and Hart, a graduate research assistant, Department of Forest and Wood Sciences.

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I. INTRODUCTION

Lightning caused forest fires are dynamic phenomena in many forest regions of North America. In the United States some 10,000 to 15,000 lightning fires occur annually. Lightning fires also are common in many forest regions of Canada and in some areas of Mexico. In the western forest regions of the United States, and in both eastern and western Canada vast areas have been burned by these fires in the last several hundred years.

Lightning fires are a vital factor in the management of wildland resources. All types of resource areas and uses are impacted including watersheds, rangelands, wilderness, commercial timberlands, wildlife and recreation areas. Lightning fires are a natural element in forest and range ecosystems and are an agent for recycling and providing diversity in wildland environments. They also may adversely impact society causing losses of needed natural resources, human life and property.

An in-depth understanding of lightning fires is essential for the development of policies and programs in overall management of forest and range resources. If we are to judiciously capture the ecological benefits of some lightning fires and at the same time minimize the societal disbenefits inherent in many situations it is necessary to advance our knowledge of the nature of these fires. This report presents a summary of information gained from studies of more than 40,000 lightning fires in Northern Rocky Mountain national forests during the 43-year period 1931-1975.

I-1. Lightning Fires in Western Forests

Lightning fires are a highly significant factor in natural resource management in the western United States. During the 28-year period 1946-1973, more than a quarter of a million lightning fires have occurred in 17 western states including the Dakotas, Nebraska, Kansas and Alaska (Table I-1). In this period lightning caused 59 percent of the fires in the Rocky Mountain and Plains states and 33 percent in the Pacific states. These data include fires on all protected forest and watershed lands in private, state and federal ownership (U.S. Forest Service, Forest Fire Statistics, 1946-1974).

In the Rocky Mountain states (exclusive of the adjacent Plains states of North and South Dakota, Nebraska and Kansas) lightning fires continue to dominate the forest fire scene. Although increases in population and forest use in recent years have brought additional numbers of man-caused fires, lightning remains as the major cause of both fire occurrence and area burned on all protected lands (Table I-2). During the period 1963-1974 lightning accounted for 61 percent of the fires and 55 percent of the area burned.

In the Pacific states including Alaska lightning fires continue to be a major factor. The percent and total number of lightning fires is lower than in the Rocky Mountain states. This ratio between lightning and man-caused fires is strongly influenced by large numbers of man-caused fires in California. During the 1963-1974 period lightning caused 31 percent of the fires and 64 percent of the area burned on all protected lands in the Pacific states (Table I-2).

The Northern Rocky Mountain states of Idaho and Montana are the scene of one of the most important lightning fire regions in the United

Table I-1. Occurrence of Lightning and Man-Caused fires on All Forest and Watershed Lands Protected by Private, State and Federal Agencies in the Western United States, 1946-1974.[1]

Year	Rocky Mountain[2] States		Pacific[3] States		Total Western States	
	Lightning	Man-Caused	Lightning	Man-Caused	Lightning	Man-Caused
1946	4025	1725	2308	5088	6333	6813
1947	4111	1509	1681	4971	5792	6480
1948	2428	1592	989	4491	3417	6083
1949	4590	1504	2993	6469	7583	7973
1950	3346	1764	2390	5079	5736	6843
1951	3787	1418	2276	6222	6063	7640
1952	3060	1842	3164	5497	6224	7339
1953	4391	1881	3192	3875	7583	5756
1954	3755	1437	1137	3721	4892	5158
1955	2405	1461	2203	3584	4608	5045
1956	5455	1906	4048	3970	9503	5876
1957	3418	1433	1519	4178	4937	5611
1958	4886	2637	5376	5995	10262	8532
1959	4405	1462	1822	4905	6227	6867
1960	6099	2561	3757	4989	9856	7550
1961	7410	1807	5925	5363	13335	7170
1962	5201	2584	2601	4640	7802	7224
1963	5778	2424	3175	4081	8953	6515
1964	4056	3026	1850	5040	5906	8066
1965	3537	2450	3562	5443	7099	7903
1966	6166	5778	2725	6341	8891	12119
1967	4663	5127	4401	5894	9064	11021
1968	4054	6141	3289	5559	7343	11700
1969	3900	3974	3294	6201	7194	10175
1970	6930	5387	4154	10031	11084	15418
1971	6335	7203	2460	6835	8795	14038
1972	7429	7380	5082	11441	12511	18821
1973	5742	7265	3505	12233	9247	19498
1974	7287	10876	3852	14497	11139	25373
Total	138649	96300	88680	176643	227329	272943
Annual Ave.	4781	3321	3058	6091	7839	9412
Percent	59.01	40.99	33.42	66.58	45.44	54.56

(1) Data from Annual Forest Fire Statistics, Division of Cooperative Fire Control, U.S. Forest Service, Washington, D.C.

(2) Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Utah and Wyoming.

(3) Alaska, California, Hawaii, Oregon and Washington.

Table I-2. Number of Lightning and Man-Caused Fires and Area Burned on All Forest and Watershed Lands Protected by Private, State and Federal Agencies in Western Rocky Mountain and Pacific States, 1963 - 1974.[1]

Year	Western Rocky Mountain States[2]				Pacific States[3]			
	No. of Fires		Acres Burned		No. of Fires		Acres Burned	
	Lightning	Man-Caused	Lightning	Man-Caused	Lightning	Man-Caused	Lightning	Man-Caused
1963	5567	2280	107472	104319	3175	4084	33243	52385
1964	3901	2343	52890	97410	1850	5032	16858	297671
1965	3349	1631	40144	36573	3562	5432	5813	136350
1966	5856	3182	430133	107868	2725	6303	670364	288658
1967	4433	2749	144489	92648	4401	5878	134328	111270
1968	3807	2450	90421	11304	3289	5534	995404	238953
1969	3647	2893	85757	128544	3294	6166	2657580	1554583
1970	6575	3254	84507	102574	4152	9966	349512	471356
1971	5881	4494	330809	255634	2460	6792	1088551	128481
1972	7199	3937	88435	164596	5082	11395	95231	208005
1973	5333	4392	300110	164127	3504	12176	185622	264702
1974	6432	5865	256953	309393	3852	14459	663951	174162
Total	61980	39970	2072120	1674990	41345	93217	6896457	3926576
Annual Ave.	5165	3331	167677	139582	3445	7768	574705	327215
Percent	61	39	55	45	31	69	64	36

(1) Data from Annual Forest Fire Statistics, Division of Cooperative Fire Control, U.S. Forest Service, Washington, D.C.

(2) Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming.

(3) Alaska, California, Oregon and Washington.

States. Only the southwestern states of Arizona and New Mexico have a higher percentage of lightning fires. During the period 1946-1974 more than 48,000 lightning fires occurred on all protected lands in Idaho and Montana (Table I-3). This is 66 percent of all fires. Data on area burned by causes is available for all protected lands only for the 1963-1974 period (U.S. Forest Service, Forest Fire Statistics, 1963-1974). During this period lightning fires burned more than one million acres in Idaho and Montana and accounted for 59 percent of the total area burned (Table I-4). In Montana 75 percent of the area burned was caused by lightning fires as compared to 55 percent in Idaho.

In the Northern Rocky Mountains the great majority of the lightning fires are in U.S. Forest Service Region One. From the beginning of the history of Region One national forests, lightning fires have been a dominant factor influencing nearly every phase of the programs for their management and protection. In the critical fire year of 1910, when management of the national forests was just beginning, massive outbreaks of fires occurred. It was estimated that some 3000 fires were burning at one time (Spencer, 1956). These fires probably included a mixture of both lightning and man-caused fires. However, all of the recorded history of the region shows the dominance of lightning fires. Spencer states in her book the Big Blowup,"lightning was the terror of the Forest Service."

On many other occasions in the early history of Region One, lightning fires caused critical situations. The years of 1919, 1925, 1926, 1931, 1934 and 1940 involved massive fire control efforts (Hornby, 1936; Barrows, 1951). The present study includes an analysis of other critical situations since 1945.

Table I-3 Occurrence of Lightning and Man-Caused Fires on all Lands Protected by Private, State and Federal Agencies in Idaho and Montana, 1946-1973.(1)

Year	No. of Fires					
	Idaho		Montana		Total	
	Lightning	Man-Caused	Lightning	Man-Caused	Lightning	Man-Caused
1946	1440	483	645	240	2085	723
1947	1087	415	856	206	1943	621
1948	322	283	162	127	484	410
1949	1395	486	866	280	2260	766
1950	745	314	286	139	1031	453
1951	894	380	379	143	1273	523
1952	798	502	371	310	1169	812
1953	1149	572	864	345	2013	917
1954	573	308	500	150	1073	468
1955	610	236	388	198	998	434
1956	956	296	694	469	1650	765
1957	784	543	600	245	1384	788
1958	1358	614	595	334	1953	948
1959	761	324	274	292	1035	616
1960	875	497	1047	360	1922	857
1961	1684	522	1158	293	2842	815
1962	983	519	567	286	1550	805
1963	1898	537	951	287	2849	824
1964	665	405	418	264	1083	669
1965	756	406	239	164	995	570
1966	1316	755	1017	391	2333	1146
1967	1503	681	811	521	2314	1202
1968	804	497	377	354	1181	851
1969	481	641	453	541	934	1182
1970	1672	506	842	492	2514	998
1971	626	664	716	550	1342	1214
1972	1641	509	713	393	2354	902
1973	1076	832	1087	650	2163	1482
1974	679	885	669	623	1348	1508
Total	29530	14612	18545	9657	48075	24269
Annual Ave.	1018	504	639	333	1658	837
Percent	67	33	66	34	66	34

(1) Data from Annual Forest Fire Statistics, Division of Cooperative Fire Control, U. S. Forest Service, Washington, D. C.

Table I-4 Acres Burned by Lightning and Man-Caused Fires on All Lands Protected by Private, State and Federal Agencies in Idaho and Montana.(1)

Year	Idaho		Montana		Total	
	Lightning	Man-Caused	Lightning	Man-Caused	Lightning	Man-Caused
1963	89224	51573	1515	6911	90739	58484
1964	5602	16644	2200	1267	7802	17911
1965	11666	15770	704	803	12370	16573
1966	291614	57945	50236	9419	341850	67364
1967	102357	33853	31030	6601	133387	40454
1968	15000	16438	4487	4955	19487	21393
1969	16675	48328	8909	4668	25584	52996
1970	23646	29650	15504	9416	39150	39066
1971	72603	208774	51131	10227	123734	219001
1972	28690	70164	3683	2927	32373	73091
1973	138809	47105	74437	14211	213246	61316
1974	24559	77443	1625	9371	26184	86834
Total	820445	673687	245461	80796	1065906	754483
Annual Ave.	68370	56141	20455	6733	88825	62874
Percent	55	45	75	25	59	41

(1) Data from Annual Forest Fire Statistics, Division of Cooperative Fire Control, U. S. Forest Service, Washington, D. C.

I-2. Background for the Research

This research of lightning fires is motivated by the challenging opportunities of forest fire management. The experience gained from some 70 years of fire control in Region One national forests provides a wealth of significant and useful information. More than 50 years of fire and interrelated atmospheric sciences research has created a body of knowledge on lightning fires and their environment. The combination of experience and research results provides a background for critical examination of lightning fire phenomena and the role of lightning fires in overall management of national forest resources. To this background we can now add a new analysis stemming from a data base contained in the reports of some 26,000 lightning fires occurring since 1945.

During the last 50 years several studies have been made of lightning fires in the Northern Rocky Mountain region. Hornby analyzed lightning fire problems during the period 1921-1930 to obtain part of the essential background for his pioneering development of fire control planning methods (Hornby, 1936). Throughout his long research career Gisborne studied lightning fires with special consideration of fire danger rating relationships (Gisborne, 1936). Barrows analyzed lightning fires during the 1931-1945 period to gain information for overall fire control planning and management (Barrows, 1951). All of these studies provided part of the needed background related to lightning fire environment, occurrence patterns, resource impacts, fire control factors and overall fire load.

Shortly after World War II a remarkable odyssey of events began in the interrelated fields of fire and atmospheric sciences. During the 30-year period 1946-1975, new knowledge of great significance to an enlarged understanding of lightning and forest fires was developed (Barrows,

1960). These developments stemmed both from general advances in science and from specific results produced by Forest Service research projects.

In cooperation with many other groups Forest Service fire research pioneered development of new knowledge and approaches to lightning fire problems. Following preliminary studies at the Priest River Experimental Forest and in Region One national forests, Dr. Vincent Schaefer pointed out the possibilities for modifying lightning storms in the Northern Rockies (Schaefer, 1949). Shortly afterwards the Forest Service organized Project Skyfire. The project objectives were: (1) to gain basic information on the occurrence, behavior and control of lightning-caused forest fires and the characteristics of storms that produce these fires; and (2) to develop methods for suppression of lightning fires, including study of cloud modification as a possible means of preventing or reducing the severity of lightning fires (Barrows, et al., 1957).

The results of Project Skyfire set the stage for the research of lightning fires presented in this report and for new concepts of fire management. The Project Skyfire results include the following:

(1) Cloud and lightning survey. Methods were developed to observe and classify cloud systems and record lightning storm events from a network of fire lookout stations stretching across Northern Rocky Mountain forests from eastern Washington to northwestern Wyoming (MacCready, Schaefer, Dieterich and Barrows, 1955). The results of this program provide information on lightning storm phenomena and a data bank on lightning storms in the Northern Rocky Mountains (Fuquay, 1975). This data bank of clouds and lightning can now be related to lightning fire occurrence at specific times and locations in Region One national forests.

(2) Lightning characteristics. Project Skyfire scientists have discovered and documented the specific features of lightning strikes that

are most likely to ignite forest fires (Fuquay, Taylor, Hawe and Schmid, 1972). These research results can now be related to the cloud and lightning survey and to lightning fire occurrence patterns.

(3) Lightning sensing. Project Skyfire has developed technology for measuring lightning features from both ground-based stations and airborne systems (Fuquay and Baughman, 1969). The present study of lightning fire occurrence patterns can produce guides for application of remote sensing technology in fire management programs.

(4) Prevention of lightning fires. Project Skyfire has presented through intensive research the facts that lightning fires can be prevented through proper application of weather modification technology (Baughman, Fuquay and Mielke, 1976; Fuquay, 1975; Fuquay and Baughman, 1969; Barrows, 1966). The results of these studies have been given rigorous examination by the scientific community and by agencies responsible for management of natural resources in the United States (Interdepartmental Committee for Atmospheric Sciences, 1971).

More recently other research has added further to the technology for evaluating lightning fire situations. The National Fire Danger Rating System developed by Forest Service fire research includes a preliminary method for rating lightning risk (Deeming, Lancaster, Fosberg, Furman and Schroeder, 1972). Now through combined analysis of lightning fire and storm data a new opportunity is presented for development of advanced methods for predicting and rating lightning risk.

One of the compelling reasons for the present study of lightning fires in Region One is the recent development of new fire management policies for wilderness areas. These policies are directed at letting lightning fires play a natural role in wilderness ecosystems. Special fire management programs to implement these policies have been developed

for some wilderness areas and are planned for others (Mutch, 1974; Daniels, 1974). These programs require an in-depth understanding of lightning fire phenomena.

The overall challenges and opportunities to develop advanced systems for lightning fire management are of tremendous significance to both wilderness and non-wilderness resource programs in Region One. We have a foundation of knowledge to measure and evaluate lightning, prevent and control lightning fires, and to better understand the role of fire in ecosystems. We are developing new criteria for classification of lightning fires as either wanted or unwanted (Barrows, 1974). All of these exciting opportunities can be aided by study of the reported features of thousands of lightning fires occurring under a wide variety of environmental factors and management requirements.

I-3. Research Objectives and Methods

Objectives

This research has the following broad goals:

1. To provide additional knowledge of lightning fires for use in the planning and management of the forest resources in the Northern Rocky Mountains.

2. To provide a continuing basis for capitalizing on previous research results of lightning fires, storms and discharges.

3. To provide a data base on lightning fires and computer programs for use in both continuing research and active fire management programs.

Specifically, the research has been performed to provide the following kinds of information:

1. Describe the distribution of lightning fire occurrence in the Northern Rocky Mountains. The variation in the temporal and spatial density of fires will be related to years, short time periods, topography, fire danger rating, forest types, and fuel types for each National Forest, and the Region as a whole.

2. Describe statistically the influence of fuel, fire danger, topography, and fire ignition on the severity of lightning fire problems. Define the critical fire problem in terms of the fire environment features associated with large outbreaks of fires, area burned and fire management operations. Analyze the features of lightning fire situations having various degrees of severity.

3. Describe the historical occurrence of critical and non-critical lightning fire situations. Identify any non-random features in the location, time or frequency of problem situations.

4. Locate and define critical fire areas, if they exist, i.e. areas with a non-random, recurrent lightning fire load. Provide a detailed analysis of the fire environment at the critical areas.

5. Describe the recent historical occurrence of fires within existing and proposed Wilderness Areas. Analyze the potential fire load in Wilderness Areas. Propose a model for utilizing historic wilderness fire data in analyzing probable long term effects of lightning fires in wilderness.

Data Base

The primary data for this research are obtained from the reports prepared by the Forest Service on individual lightning fires occurring during the period 1946-1973. These data are supplemented for selected parts of the studies by research performed on lightning fires during the period 1931-1945 (Barrows, 1951). Other data used in the research includes description of the region, national forests, wilderness areas and fire environment factors. Supplemental data was obtained from U.S. Forest Service reports and maps.

The basic fire report data were obtained in magnetic tape form for computer processing. The initial work involved studying the preliminary computer outputs and cleaning up the data to eliminate any obvious errors and omissions. The initial fire data had to be studied in relation to four different sets of coding instructions for computer processing in the four decades involved (46-49; 50-59; 60-69 and 70-73).

An important objective of the study is to compare wilderness and non-wilderness lightning fire situations. Legal descriptions permitting identification of fires in wilderness and primitive areas, wilderness study areas and non-wilderness areas were available on fire reports only for the 1960-1973 period. The 1950-1959 period was added to the data base through a hand sorting and compiling operation performed by a dedicated group of Region One smokejumpers.

Other differences in the data by time periods, coding decades and terminology had to be resolved. Forest type descriptions were placed in a standard format. Differences in fire danger rating descriptions caused by use of four different systems during the study period were resolved through adoption of five standard classes of burning index (low, medium,

high, very high and extreme) for the entire 28-year data base. Explanation of these date standardization procedures is in Chapter III-4.

All of the above clarifications of the data were placed in a new coding format for computer processing. A series of new magnetic tapes were then prepared for computer use in the research.

A few desirable corrections to the data base could not be made because of incomplete information or unreconcilable changes in individual fire report coding instructions during different decades. For example some actionable Class D or larger fires were coded as 0 acres burned. Elevation zone classes were changed from the even 1,000 foot zones long used to new classes such as 3,500 to 4,499, 4,500 to 5,499 etc. These changes mitigated against continuing study of fire occurrence per unit area in accordance with the available topographic data and the results of previous elevation zone research. Selected other items of fire control and fire environment information also could not be used because of fire report omissions or changes in coding instructions.

In spite of the above difficulties, the overall data base is very substantial. This probably is the most complete data base on lightning fires available anywhere. In its present computer format it is highly useful for both research and fire management purposes.

Research Methods

This entire research effort involves the use of data gathered by others. Some additional observations stem from the experience of the authors. The basic methodology for the research required the development or adaptation of computer programs, data processing formats and analytical and statistical procedures.

We adopted a procedure of examining the fire data in two major dimensions:

(1) Temporal -- years, months, periods of days and individual days.

(2) Spatial -- region, states, zones, groups of national forests, individual national forests and individual areas (including wilderness, primitive, wilderness study and non-wilderness areas).

Several special computer programs were prepared for this research. All programs were written in CDC Extended Fortran.

Program	Purpose
BUF2CSU	Converts a USFS buffered tape containing individual fire reports, to a formatted tape compatible with CSU Fire Science programs, while standardizing all data codes to one base set.
PLØTLØC	Plots the location of fires according to range and township. An area of 22,500 square miles can be plotted on one frame of microfilm.
PLØT3	A Fortran callable set of subroutines for plotting a maximum of 3 two-dimensional graphs per frame of microfilm with labels and titles.

Program	Purpose
LPPLØTS	Computes and plots the number of fires and acres burned for a specified time period with a user specified daily increment, i.e. 1 May to 31 Sep by 3-day periods.
FFL	Produces a yearly summary of number of fires by size class with acres burned per million acres being computed from the yearly acreages for each forest.
PCTSAM	Produces a tabular output of the size class distribution of fires within a fire environment category (i.e. ten-day period, fire danger, slope, elevation, aspect, cover type, fuel type) for each forest group and zone. The output was the basis for the tables in Section III of this report.
WILDSAM	Compares the legal description coded on the individual fire reports with the legal description of Wilderness, Primitive, and New Study areas and adds a wilderness code number to the fire record. Each record contains a "0" in column 4-5 if the fire burned in a non-classified area, and an integer from 1-91 if in a classified area.
WLØDSAM	Details and summarizes the annual fire load within each classified area. The output of WLØDSAM produces tables such as Tables VI-7 and VI-7a.
WTDSAM	Summarizes the number of fires and the area burned in each classified area in each 10-day burning period, cover type, and fire danger rating adjective class. Example output from WTDSAM includes Tables VI-8 through VI-11, and VI-13 to VI-14.
DIFFSAM	Compares each descriptor of fire environment for classified and non-classified area fires. Performs a statistical test to compare the percentage of fires in each cover type, ten-day period, fire danger class, fuel type, elevation zone, and slope class. Output from DIFFSAM was the basis for tables VI-2 through VI-6.
REGSAM	Produces a tabular output of the fire load and fire size class distribution for each day, ten-day period, month, and year for each forest and the region as a whole. The output forms the basis for much of chapters II-1 to II-3, and produced Table VI-1.

These computer programs are available from the authors by request. The documented programs and complete descriptions will be transmitted via a publication that will follow acceptance of this final report.

The data from these computer outputs is presented as follows:

(1) Summarized in tables, figures or narrative material in the text.

(2) Supplementary information summaries in the Appendix.

(3) A data bank furnished in a series of magnetic tapes for computer use.

The narrative descriptions and conclusions on lightning fires are those of the authors prepared following appropriate analytical and statistical procedures.

II. THE LIGHTNING FIRE LOAD

In this research recognition is given to many factors characterizing the impact of lightning fires on forest resources and on forest management organizations. This impact has long been described as the fire load. The definition of fire load as applied in this research is "the total impact of fire occurrence and fire growth on the requirements of management organizations to meet natural resource protection and utilization objectives."

Northern Rocky Mountain lightning fires have several distinctive features that characterize the dimensions of the fire load. These features include:

(1) Outbreaks of large numbers of fires in a short time period.

(2) Great differences in the time periods for maximum fire occurrence.

(3) Great variations in the flammability of fuels at the times of fire occurrence and in periods following fire occurrence.

(4) Distinctive areas of maximum fire occurrence.

(5) Occasional simultaneous occurrence of fire ignitions and weather conditions favoring development of large fires.

(6) Great variations by years in the length of the lightning fire season, the number of fires and the area burned.

Our studies of fire load concentrate first on the basic features of fire occurrence, size class of fires and area burned. Later in this report attention is given to other factors including fire environment, fire control and critical lightning fire situations.

II-1. Fire Occurrence

Regional Fire Occurrence

Lightning causes more than three-fourths of the fires. During the 43-year period 1931-1973 lightning accounted for 77 percent of the fires in Region One national forests. Very little change has occurred in the distribution between lightning and man-caused fires during the 1931-1945 and 1946-1973 periods. The results of the earlier period study (Barrows, 1951) and the present study show the following distribution:

Years	Lightning Fires		Man-Caused Fires	
	No.	%	No.	%
1931-1945	17,012	75.83	5,423	24.17
1946-1973	26,847	77.14	7,957	22.86
1931-1973	43,859	76.62	13,380	23.38

Great annual variation exists in lightning fire occurrence. The peak annual occurrence recorded to date is more than eleven times greater than the lowest year. As shown in Table II-1 the all time maximum occurrence in a single year was 3,109 lightning fires in 1940. The all time low was 274 fires in 1948. The 43-year annual average occurrence is 1020 lightning fires. More than 1400 fires have occurred in five years and less than 500 fires in only two years.

The average annual lightning fire occurrence is more than 38 fires per million acres. The occurrence rate was somewhat higher during the 1946-1973 period than in the 1931-1945 period (Table II-1). This difference may be caused, in part, by the lower protection acreage during the latter period. Many areas in other ownerships outside of national forest boundaries at lower elevations have been eliminated from the protection base. During the 1946-1973 period the average annual occurrence rate was 40.91 fires per million acres.

Table II-1. Lightning Fire Occurrence During 1931-1945 and 1946-1973 Periods in Region One National Forests.

Year	No. of Fires	Year	No. of Fires
1931	963	1946	1345
		1947	1346
1932	806	1948	274
		1949	1365
1933	652	1950	529
		1951	775
1934	817	1952	630
		1953	1357
1935	959	1954	580
		1955	623
1936	1355	1956	937
		1957	755
1937	1154	1958	1071
		1959	567
1938	1136	1960	1003
		1961	2054
1939	1372	1962	912
		1963	1582
1940	3109	1964	567
		1965	549
1941	1146	1966	1235
		1967	1426
1942	867	1968	538
		1969	469
1943	538	1970	1418
		1971	687
1944	1227	1972	1007
		1973	1253
1945	911		
Total	17012		26854
Average Annual No. of Fires	1134		959
Average Annual No. of Fires Per Million Acres	38.18		40.91

July and August are the peak lightning fire months. During the 1946-1973 period more than 80 percent of the fires occurred in these months with August alone accounting for nearly 51 percent (Table II-2). It is interesting to note that during the 1931-1945 period July rather than August had the highest average monthly fire occurrence (Barrows, 1951). This variation during the two periods is strongly influenced by the outbreak of more than 2000 lightning fires in July 1940 -- an all-time peak in monthly occurrence. During the 1946-1973 period more than 1000 lightning fires occurred during August in three of the years with the peak occurrence of 1344 fires being recorded in 1961. During the same period the peak July occurrence was 692 fires in 1960.

Large numbers of lightning fires occasionally occur in June and September. While the average occurrence in June is only 54 fires there were five years during the 1946-1973 period when more than 100 lightning fires occurred,with the peak number of 150 being recorded in 1971. The September average occurrence is 99 fires. During 11 years more than 100 lightning fires occurred in September,with the peak number of 439 being recorded in 1966 (Table II-2).

Early and late season outbreaks of lightning fires are rare. Average annual occurrence in April is only one fire. More than two fires in this month were recorded in only three years. Average annual occurrence in May is 15 fires. However large variations in this average have been recorded. Peak occurrence levels in May were 107 lightning fires in 1966 and 80 in 1958. October average occurrence is five fires. Peak outbreaks of 58 fires were recorded in 1963 and 35 in 1957 (Table II-2).

Large numbers of fires occur in ten-day periods during July and August. During the years 1946-1973 the average number of fires was greatest during the middle ten-day period of August (Table II-3). The

Table II-2. Lightning Fire Occurrence by Months, 1946-1973, Region One National Forests.

Year	April	May	June	July	Aug	Sept.	Oct.	Total
1946	6	9	79	338	783	130	0	1345
1947	1	13	11	561	702	57	0	1345
1948	0	7	26	96	133	8	4	274
1949	5	25	34	344	873	83	1	1365
1950	0	1	54	198	161	115	0	529
1951	0	6	3	308	441	17	0	775
1952	0	17	47	138	288	133	7	630
1953	0	4	18	220	1025	88	2	1357
1954	0	16	19	145	348	52	0	580
1955	0	1	112	201	120	189	0	623
1956	0	15	82	338	437	63	2	937
1957	1	15	27	421	223	33	35	755
1958	0	80	102	326	400	163	0	1071
1959	0	2	32	80	437	15	0	566
1960	0	6	38	692	204	60	3	1003
1961	0	18	150	500	1344	42	0	2054
1962	1	7	102	555	226	19	2	912
1963	0	6	47	274	1038	158	58	1581
1964	0	4	39	332	186	6	9	567
1965	2	6	16	339	176	8	2	549
1966	1	107	78	334	270	439	5	1234
1967	0	5	35	445	693	249	8	1426
1968	1	8	26	208	258	36	1	538
1969	11	5	63	34	153	292	1	469
1970	0	6	102	459	602	244	2	1415
1971	1	23	12	108	533	9	0	687
1972	0	18	60	320	580	26	3	1007
1973	0	3	96	63	962	129	0	1253
Total	30	433	1511	8377	13596	2764	136	26847[1]
Annual Average	1.07	15.46	53.96	299.18	485.57	98.71	4.86	958.82
Percent	0.11	1.61	5.63	31.20	50.64	10.30	0.51	

(1) Seven additional fires occurred between October and April.

average daily occurrence of 17.36 fires during this ten-day period was only slightly greater than the daily average of 16.64 fires during the first ten days of August. These patterns differ from those recorded in the years 1931-1945 when the highest average occurrence was in the last decade of July and the second highest in the middle decade of this month (Barrows, 1951).

Average occurrence of more than 100 fires in ten-day periods is common. As shown in Table II-3 the average annual occurrence exceeded 100 lightning fires in five successive periods from mid-July through August during the years 1946-1973. Again this pattern differs from the years 1931-1945 when a remarkable lull in lightning fire occurrence was recorded in the first ten-day period of August (Barrows, 1951). The 43-year (1931-1973) average occurrence of lightning fires during the five peak periods is as follows:

Period	Number of Fires	
	Period Average	Daily Average
July 11-20	144	14.4
July 21-31	154	14.0
August 1-10	139	13.9
August 11-20	157	15.7
August 21-31	152	13.8

Peak occurrence exceeds 400 fires in a ten-day period. During the years 1946-1973 400 or more lightning fires in a ten-day period occurred twice in July and seven times in August. The peak occurrence of 799 fires was recorded during the last decade of August in 1961. In this same year 460 fires occurred in the middle period of August creating a load of 1259 lightning fires in 21 days (Table II-3). The all time peak occurrence in a ten-day period was 1488 lightning fires during the middle decade of July 1940 (Barrows, 1951).

Table II-3 Lightning Fire Occurrence by Monthly Ten-Day Periods 1946-1973 In Region One National Forests

Year	June	July			August			Sept.	
	21-30	1-10	11-20	21-31[1]	1-10	11-20	21-31[1]	1-10	11-20
1946	32	50	42	246	138	303	342	126	3
1947	4	97	237	227	395	85	222	50	4
1948	4	15	58	23	68	53	12	3	4
1949	14	66	230	48	260	400	213	72	3
1950	5	53	40	105	73	42	46	92	19
1951	1	68	12	228	192	194	55	12	3
1952	14	45	71	22	197	57	34	75	32
1953	7	15	130	75	516	370	139	45	21
1954	10	53	68	24	30	264	59	13	19
1955	94	34	68	99	20	58	42	158	30
1956	4	40	135	163	225	111	101	33	26
1957	1	15	164	242	68	88	67	22	7
1958	28	72	116	138	87	153	160	50	96
1959	18	18	5	57	321	70	46	2	13
1960	32	66	429	197	100	90	14	26	31
1961	63	161	150	189	85	460	799	12	29
1962	80	83	33	439	109	72	45	5	4
1963	10	182	40	52	330	480	228	84	47
1964	38	167	124	41	24	150	12	3	2
1965	4	102	34	203	96	42	38	6	2
1966	41	83	172	79	129	57	84	142	258
1967	11	39	276	130	213	382	98	201	23
1968	14	61	69	78	148	105	5	11	23
1969	3	18	3	13	27	67	59	48	143
1970	57	32	313	114	108	40	454	244	0
1971	10	36	33	39	338	93	102	9	0
1972	14	133	35	152	181	282	117	20	6
1973	89	16	26	21	181	292	489	115	13
Total	702	1820	3113	3444	4659	4860	4077	1679	861
Annual Ave.	25.07	65.00	111.18	123.00	160.39	173.57	145.61	59.96	30.75
Daily Ave.	2.51	6.50	11.12	11.18	16.64	17.36	13.24	6.00	3.07

(1) Eleven days in period.

Very large numbers of lightning fires may occur in a single day. During the 1931-1945 period 50 or more lightning fires occurred in Region One national forests on 76 days with these outbreaks being recorded in every month from May through September (Barrows, 1951). As shown in Table II-4 regional loads of 50 or more fires were recorded on 107 days during the 1946-1973 period. These daily regional loads occurred only in the months of July, August and September during the latter period. The 43-year period distribution of days with 50 or more lightning fires is as follows:

Period	May	June	July	August	September	Total
1931-45	2	5	35	30	4	76
1946-73	0	0	24	72	11	107
1931-73	2	5	59	102	15	183
Annual Ave.	0.05	0.12	1.37	2.37	0.35	4.26

Peak regional loads often exceed 100 lightning fires in a single day. During the 1946-1973 period there were 25 days with more than 100 fires and 5 with more than 200. The all-time peak occurrence was 356 lightning fires on August 31, 1970 (Table II-4). This exceeds the previous record of 335 fires on July 12, 1940 (Barrows, 1951). In some years there are several days with peak loads. Days with more than 100 fires include 5 in 1961, 4 in 1970 and 3 in 1963 and 1973.

Table II-4. Days When 50 or More Lightning Fires Occurred in Region One National Forests, 1946-1973.

Year	Date	Fires	Year	Date	Fires	Year	Date	Fires
1946	7-29	154	1954	8-14	67	1964	7-8	69
	7-30	53		8-15	68		8-15	59
	8-4	53						
	8-12	96	1955	9-8	61	1965	7-26	110
	8-21	76						
	8-25	64	1956	8-1	60	1966	9-8	51
							9-11	53
1947	7-10	70	1957	8-13	69		9-12	93
	7-14	79						
	8-3	71	1958	7-29	57	1967	7-13	113
	8-4	60		8-11	86		7-14	65
	8-7	112		8-26	50		8-5	74
	8-29	69		9-11	54		8-6	57
	8-30	65					8-11	93
			1959	8-1	205		8-12	104
1948		None		8-2	58		8-21	56
							9-6	53
1949	7-11	66	1960	7-13	87			
	7-12	65		7-14	121	1968	7-28	53
	8-4	77		7-20	84		8-3	69
	8-18	67		8-14	60		8-11	69
	8-19	64						
	8-20	76	1961	7-5	51	1969	9-12	60
	8-21	59		7-16	62			
	8-23	71		8-15	220	1970	7-16	79
				8-16	99		7-17	108
1950	8-27	53		8-17	58		8-31	356
	9-5	52		8-22	137		9-1	136
				8-23	51		9-2	76
1951	7-25	64		8-24	209	1971	8-3	113
	7-28	53		8-25	102		8-5	88
	8-1	91		8-28	97			
	8-11	104		8-29	119	1972	7-6	53
							7-7	57
1952	8-6	69	1962	8-25	97		8-15	54
				8-26	105		8-19	52
1953	7-13	50						
	8-3	70	1963	8-4	141	1973	8-10	91
	8-4	50		8-6	75		8-11	73
	8-6	78		8-12	109		8-13	105
	8-7	94		8-13	57		8-22	240
	8-8	118		8-14	109		8-23	140
	8-16	87		8-19	72		9-6	64
	8-19	69		8-24	53			
	8-20	59						

Fire Occurrence In The Western and Eastern Zones

In this study Region One has been divided into Western and Eastern Zones. Within each of the zones fires are analyzed by individual national forests and groups of national forests. Because of many variations in forest boundaries and ownerships we compiled the acreage figures for each national forest separately for each year of the study. This procedure facilitated examination of both fire occurrence and acres burned per unit area throughout the region. A summary of the subdivision of the region is presented in Table II-5.

85 percent of the Region One lightning fires occur in the Western Zone. During the 43-year period 1931-1973 a total of 37,849 lightning fires occurred in western zone national forests. This was 85.4 percent of the fires occurring in the region during this period. A summary of western zone lightning fire occurrence is as follows:

Years	Average Annual No. of Fires	Average Annual No. of Fires Per Million Acres
1931-1945	1029	51
1946-1973	797	54
1931-1973	880	53

Lightning fire occurrence is low in the Eastern Zone. During the 1931-1973 period 6465 lightning fires occurred in the zone, only 15 percent of the regional total. Occurrence per million acres is less than one-third that of the western zone. A summary of eastern zone lightning fire occurrence is as follows:

Years	Average Annual No. of Fires	Average Annual No. of Fires Per Million Acres
1931-1945	135	10
1946-1973	159	20
1931-1973	150	15

Table II-5. Acres Within Forest Boundaries by Zones, Groups of Forests and Individual National Forests, U.S. Forest Service, Region One (Excludes National Grasslands).(1)

Unit	1973 Acres
Western Zone	
Southwestern Group	
Bitterroot N.F.	1,575,895
Clearwater N.F.	1,675,471
Nezperce	2,198,492
Group Total	5,449,958
Northwestern Group	
Coeur d'Alene N.F.	723,516
Colville N.F.	943,793
Kaniksu N.F.	1,622,346
St. Joe N.F.	862,918
Group Total	4,152,573
North Central Group	
Cabinet N.F.	(2)
Flathead N.F.	2,364,614
Kootenai N.F.	1,813,750
Lolo N.F.	2,089,673
Group Total	6,268,037
Western Zone Total	15,870,568
Eastern Zone	
Northeastern Group	
Deerlodge N.F.	1,176,321
Helena N.F.	969,053
Lewis and Clark N.F.	1,835,264
Group Total	3,980,638
Southeastern Group	
Beaverhead N.F.	2,113,397
Custer N.F.	1,187,200
Gallatin N.F.	1,714,921
Group Total	5,015,518
Eastern Zone Total	8,996,156
Region One Total	24,866,724

(1) Data from National Forest Areas report, U.S. Forest Service, Washington, D.C., 1973.

(2) Cabinet National Forest eliminated in 1954 with acreage redistributed to adjacent national forests.

The Southwestern Group of national forests has the highest lightning fire occurrence in Region One. A total of 15,042 lightning fires occurred in these forests during the period 1931-1973 for an annual average of 350 fires. The average annual ignition rate over the 43-year period was 71 fires per million acres. This rate was 64 fires during the 1946-1973 period (Table II-6). The Nezperce National Forest leads all forests in Region One in total lightning fire occurrence with 2085 fires during the 1931-1945 period and 3899 during 1946-1973.

The Northwestern Group ranks second in lightning fire ignition rate. During the 1946-1973 period an annual average of 56 fires per million acres occurred in this group (Table II-6). However, the St. Joe National Forest with an annual average of 83 lightning fires per million acres led all forests in Region One. During the 43-year period 1931-1973 a total of 10004 lightning fires occurred in this group for an annual average of 233 fires. This average was reduced to 212 fires in the 1946-1973 period.

The North Central group has the lowest lightning fire ignition rate in the Western Zone. During the 1946-1973 period an annual average of 43 lightning fires occurred per million acres (Table II-6). However, total fire occurrence is second only to the Southwestern group. A total of 12803 fires occurred during the 1931-1973 period for an annual average of 289 fires. This average increased to 303 fires in the 1946-1973 period. A remarkable change in lightning fire occurrence has been noted on the Flathead National Forest. During the 1931-1945 period the annual average was 93 fires (Barrows, 1951). This average dropped to 52 fires in the 1946-1973 period. The annual average of 22 fires per million acres on the Flathead during the latter period is the lowest in the Western Zone and is also lower than the ignition rates on the Custer and Helena National Forests in the Eastern Zone.

Table II-6 Lightning Fire Occurrence by Zones, Groups and Individual National Forests In Region One, 1946-1973

Zone, Group and National Forest	Total Fires	Ave. Annual No. of Fires	Ave. Annual No. of Fires Per Million Acres
Southwestern Group			
Bitterroot	2782	99.36	58.88
Clearwater	2586	92.36	67.38
Nezperce	3899	139.25	66.31
Group Total	9267	330.96	64.19
Northwestern Group			
Colville	999	35.68	41.98
Coeur d'Alene	1131	40.39	55.86
Kaniksu	1845	65.89	42.78
St. Joe	1964	70.14	82.79
Group Total	5939	212.10	55.85
North Central Group			
Cabinet(1)	513	64.13	55.71
Flathead	1444	51.57	22.16
Kootenai	2205	78.75	43.42
Lolo	3046	108.79	52.55
Group Total	7208	303.24	43.46
Western Zone Total	22414	796.43	54.50
Southeastern Group			
Beaverhead	537	19.18	9.01
Custer	1089	38.89	33.04
Gallatin	478	17.07	10.04
Group Total	2104	75.14	17.36
Northeastern Group			
Deerlodge	609	21.75	18.44
Helena	1066	38.07	39.42
Lewis and Clark	661	23.61	12.74
Group Total	2336	83.43	23.70
Eastern Zone Total	4440	158.57	20.51
Region One Total	26854	959.18	40.41

(1) Includes only 1946-1953 period

Peak occurrence in a single year exceeds 400 lightning fires in all groups of forests in the Western Zone. In the Southwestern group more than 400 fires occurred in nine years of the 1946-1973 period (Table II-7). The peak occurrence in this group was 712 fires in 1961. More than 400 fires also occurred in these years in the Northwest group and five years in the North Central group. The peak occurrence was 520 fires in the Northwest group in 1961 and 486 fires in the North Central group in 1973 (Tables II-8 and II-9).

Peak occurrence in a single year exceeds 200 lightning fires in five of the Western Zone national forests. During the 1946-1973 period there were 12 occasions when single year occurrence exceeded 200 fires (Tables II-7, II-8 and II-9). This level of fire occurrence was recorded in six years on the Nezperce, two years on the Bitterroot and Lolo and one year on the Clearwater and St. Joe. Single year occurrence of more than 150 fires was recorded on every Western Zone national forest except the Coeur d'Alene and Colville where the peak occurrence was 115 and 116 fires, respectively. There were 29 occasions during 1946-1973 when single year occurrence on an individual Western Zone national forest exceeded 150 lightning fires.

The Nezperce National Forest leads all Region One forests in peak single year fire occurrence. This is the only national forest in the region recording more than 300 lightning fires in a single year during the 1946-1973 period (Table II-7). On the Nezperce, 301 fires occurred in 1946, 317 in 1961 and 365 in 1967. During 11 separate years more than 150 fires occurred. No other forest had more than four years with occurrence in excess of 150 fires.

The Northeastern group has the highest lightning fire occurrence in the Eastern Zone. During the 1931-1973 period 3551 fires occurred for

Table II-7. Lightning Fire Occurrence 1946-1973, In the Southwest Group of National Forests, Western Zone, Region One.

Year	Bitterroot	Clearwater	Nezperce	Group Total
1946	109	153	301	563
1947	124	73	81	278
1948	34	19	15	68
1949	94	80	181	355
1950	57	70	72	199
1951	76	98	151	325
1952	68	69	84	221
1953	142	84	186	412
1954	103	24	60	187
1955	102	28	77	207
1956	100	111	98	309
1957	84	13	107	204
1958	87	107	159	353
1959	42	70	140	252
1960	96	52	92	240
1961	203	192	317	712
1962	69	99	72	240
1963	122	169	183	474
1964	46	81	51	178
1965	51	98	129	278
1966	211	101	135	447
1967	185	138	365	688
1968	84	71	101	256
1969	42	54	58	154
1970	88	264	203	555
1971	90	49	49	188
1972	175	82	224	481
1973	98	137	208	443
Total	2,782	2,586	3,899	9,267
Annual Average	99.36	92.36	139.25	330.96
Annual Average of Fires per Million Acres	58.88	67.38	66.31	64.19

Table II-8. Lightning Fire Occurrence 1946-1973, In the Northwest Group of National Forests, Western Zone, Region One.

Year	Coeur d'Alene	Colville	Kaniksu	St. Joe	Group Total
1946	71	13	102	119	305
1947	115	74	142	119	450
1948	19	24	34	19	96
1949	74	46	147	88	355
1950	10	22	53	82	167
1951	25	23	36	86	170
1952	23	18	60	44	145
1953	43	47	39	92	221
1954	16	11	42	17	86
1955	34	29	73	34	170
1956	36	20	31	56	143
1957	25	15	34	54	128
1958	92	73	132	61	358
1959	6	21	18	71	116
1960	8	22	24	45	99
1961	99	116	165	140	520
1962	66	53	78	103	300
1963	65	67	105	280	517
1964	34	17	48	46	145
1965	37	28	44	29	138
1966	34	54	85	33	206
1967	37	65	114	48	264
1968	6	21	51	15	93
1969	4	8	22	11	45
1970	78	24	55	134	291
1971	31	17	26	49	123
1972	38	31	52	58	179
1973	5	40	33	31	109
Total	1,131	999	1,845	1,964	5,939
Annual Average	40.39	35.68	65.89	70.14	212.10
Annual Average of Fires per Million Acres	55.86	41.98	42.78	82.79	55.85

Table II-9. Lightning Fire Occurrence 1946-1973, In the Northcentral Group of National Forests, Western Zone, Region One.

Year	Cabinet	Flathead	Kootenai	Lolo	Group Total
1946	64	67	89	130	350
1947	95	69	186	96	446
1948	23	11	11	15	60
1949	112	60	118	132	422
1950	31	21	18	38	108
1951	60	32	24	85	201
1952	38	18	43	64	163
1953	90	86	100	166	442
1954		23	59	95	177
1955		20	38	83	141
1956		25	71	118	214
1957		54	57	133	244
1958		62	136	95	293
1959		40	6	83	129
1960		69	130	131	330
1961		71	151	262	484
1962		71	110	92	273
1963		100	124	173	397
1964		19	70	56	145
1965		12	19	54	85
1966		44	38	137	219
1967		82	138	107	327
1968		18	43	54	115
1969		69	13	78	160
1970		51	188	140	379
1971		57	85	76	218
1972		40	38	122	200
1973		153	102	231	486
Total	513	1,444	2,205	3,046	7,208
Annual Average	64.13	51.57	78.75	108.79	303.24
Annual Average of Fires per Million Acres	55.71	22.16	43.42	52.55	43.46

an annual average of 83 fires. The average annual occurrence rate is 24 fires per million acres (Table II-6). The Helena National Forest leads the group both in total number of fires and number per million acres. The average annual occurrence rate on the Helena of 39 fires per million acres is more than double that of any other national forest in the group. The Deerlodge National Forest ranks second in the group in both total lightning fire occurrence and number of fires per million acres. The Helena and Deerlodge forests straddle the Continental Divide. This topographic position may have an important influence on lightning occurrence.

The Southeastern group has the lowest lightning fire occurrence in Region One. During the 1931-1973 year period 2914 fires occurred for an annual average of 68 fires. Lightning fire occurrence increased in this group during the 1946-1973 period. The Custer National Forest has the highest lightning fire occurrence in the group. The average annual ignition rate of 33 fires per million acres is second only to the Helena in the Eastern Zone. As shown later in this report the peak lightning fire occurrence on the widely different environments of the Custer is in the high mountain areas in the western part of the forest.

Years with more than 200 fires are rare in the Northeastern and Southeastern groups. Only twice in the 1946-1973 period was single year occurrence in either group in excess of 200 lightning fires (Tables II-10 and II-11). The Southeastern group recorded 211 fires in 1961 and the Northeastern group 244 fires in 1966. More than 100 fires were recorded in six years in the Southeastern group and in 10 years in the Northeastern group. Single year occurrence exceeded 300

Table II-10. Lightning Fire Occurrence 1946-1973, In the Northeast Group of National Forests, Eastern Zone, Region One.

Year	Deerlodge	Helena	Lewis & Clark	Group Total
1946	19	43	12	74
1947	28	42	20	90
1948	6	12	9	27
1949	45	64	35	144
1950	10	18	1	29
1951	7	34	9	50
1952	11	17	7	35
1953	53	54	57	164
1954	14	29	17	60
1955	9	15	23	47
1956	28	63	38	129
1957	26	53	37	116
1958	10	17	8	35
1959	10	10	9	29
1960	37	107	51	195
1961	46	97	68	211
1962	10	25	17	52
1963	10	74	34	118
1964	14	30	7	51
1965	2	16	2	20
1966	42	48	29	119
1967	28	31	23	82
1968	18	11	4	33
1969	12	16	27	55
1970	22	37	35	94
1971	29	44	29	102
1972	36	24	13	73
1973	27	35	40	102
Total	609	1,066	661	2,336
Annual Average	21.75	38.07	23.61	83.43
Annual Average of Fires per Million Acres	18.94	39.42	12.74	23.70

Table II-11. Lightning Fire Occurrence 1946-1973, In the Southeast Group of National Forests, Eastern Zone, Region One.

Year	Beaverhead	Custer	Gallatin	Group Total
1946	17	17	19	53
1947	26	41	15	82
1948	6	12	5	23
1949	26	48	15	89
1950	10	12	4	26
1951	7	17	5	29
1952	13	39	14	66
1953	36	54	28	118
1954	18	32	20	70
1955	14	21	23	58
1956	23	78	41	142
1957	24	22	17	63
1958	10	12	10	32
1959	8	23	10	41
1960	50	52	37	139
1961	40	59	28	127
1962	18	17	12	47
1963	17	46	13	76
1964	16	21	11	48
1965	11	16	1	28
1966	42	159	43	244
1967	9	41	15	65
1968	10	25	6	41
1969	11	38	6	55
1970	24	52	23	99
1971	18	19	19	56
1972	13	54	7	74
1973	20	62	31	113
Total	537	1,089	478	2,104
Annual Average	19.18	38.89	17.07	25.05
Annual Average of Fires per Million Acres	9.01	33.04	10.04	17.36

lightning fires in only three years in the entire Eastern Zone with 334 fires in 1960, 338 in 1961 and 363 in 1967.

In some years 50 or more fires occur in an Eastern Zone national forest. Each Eastern Zone forest except the Gallatin recorded lightning fires at this level in a single year during the 1946-1973 period (Tables II-10 and II-11). 50 or more fires were recorded in 8 years on the Custer, 7 on the Helena, 3 on the Lewis and Clark and 1 on both the Beaverhead and Deerlodge. Peak occurrences were 159 fires on the Custer in 1966 and 107 fires on the Helena in 1960. These were the only years when more than 100 lightning fires were recorded in an Eastern Zone national forest. More than 100 fires in a single day have been recorded in a Western Zone national forest.

Local Zones of Fire Occurrence

In this study machine readable data were available to show the specific location of lightning fires by section, township and range for the 1960-1973 period. Through use of a computer program (See Chapter II-3) we positioned these fires by townships in each national forest. From these procedures a series of maps of fire location on individual national forests or groups of forests were prepared.

The fire location maps are presented in Figures II-1 through II-24. Each dot on these maps shows the approximate location of a lightning fire. To facilitate use of the maps in studies of high density fire occurrence zones separate figures were prepared for the 1960-1969 and 1970-1973 periods. Cross reference from the maps to specific data on fires in each township can be made through use of the data bank (see Appendix).

LIGHTNING FIRE LOCATION: BITTERROOT, CLEARWATER AND NEZPERCE N.F., 1960-69

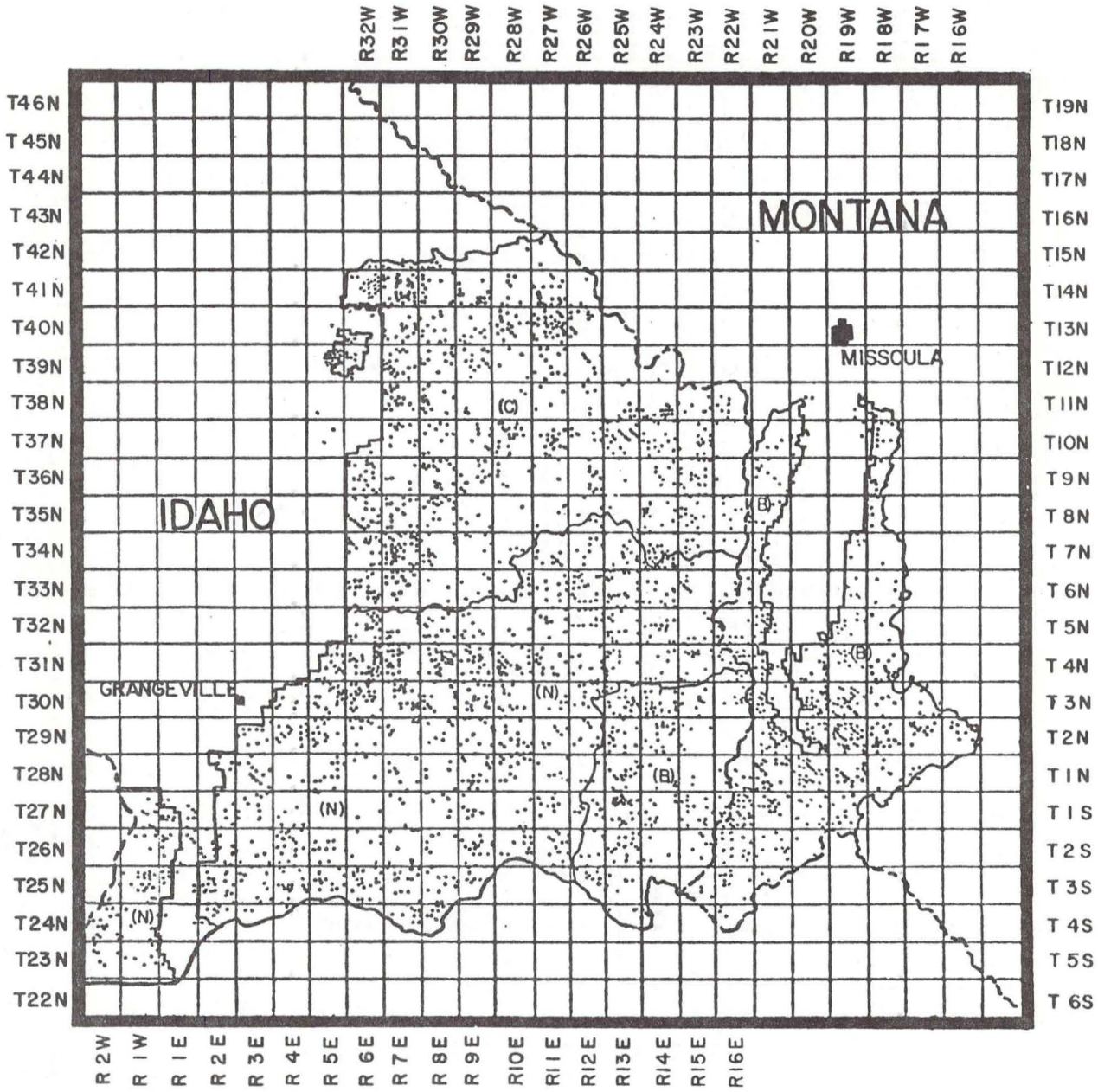

Figure II-1

LIGHTNING FIRE LOCATION: BITTERROOT, CLEARWATER AND NEZPERCE N.F., 1970-73

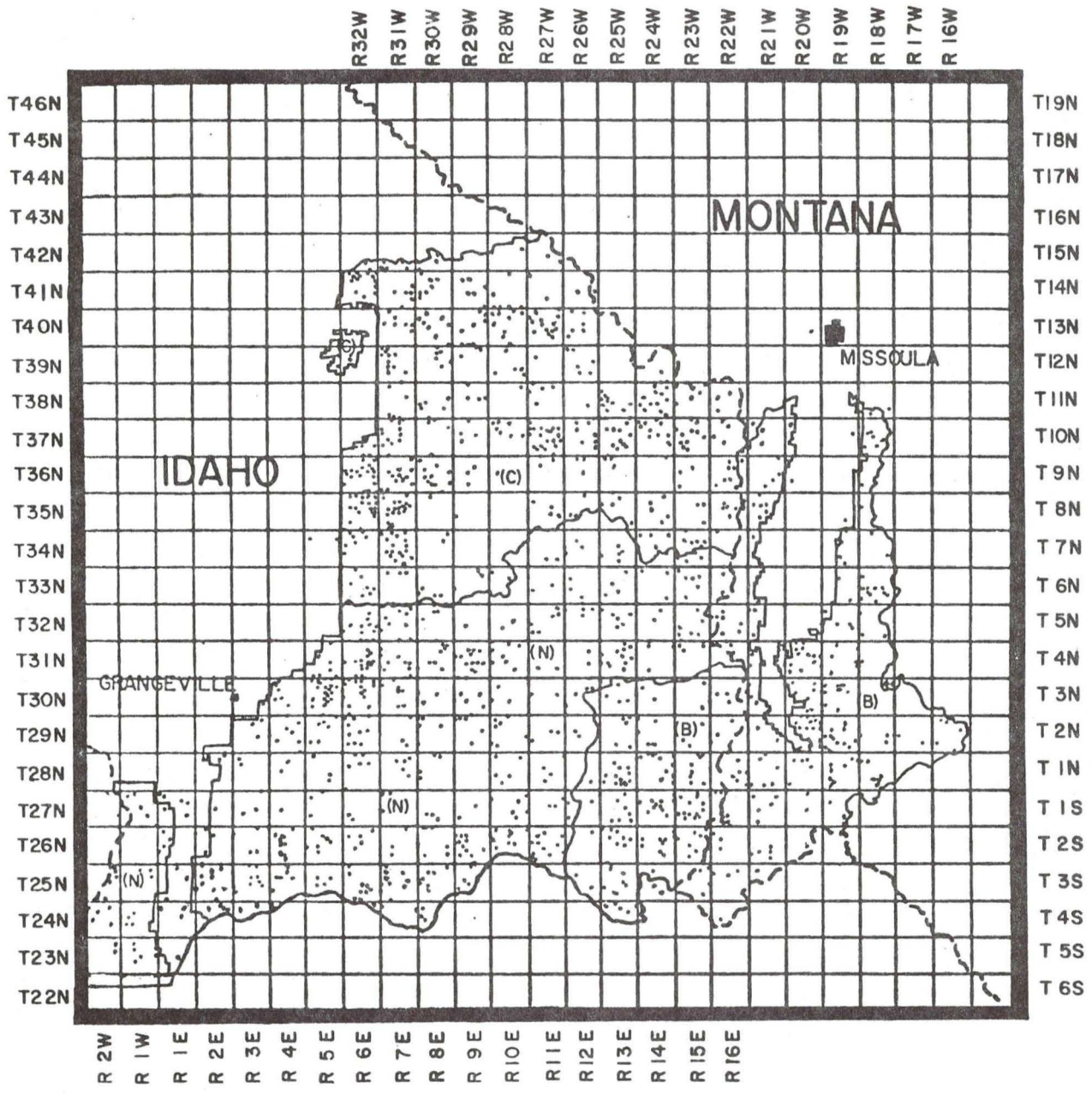

Figure II-2

LIGHTNING FIRE LOCATION: ST. JOE, CLEARWATER, AND NEZPERCE N.F., 1960-69

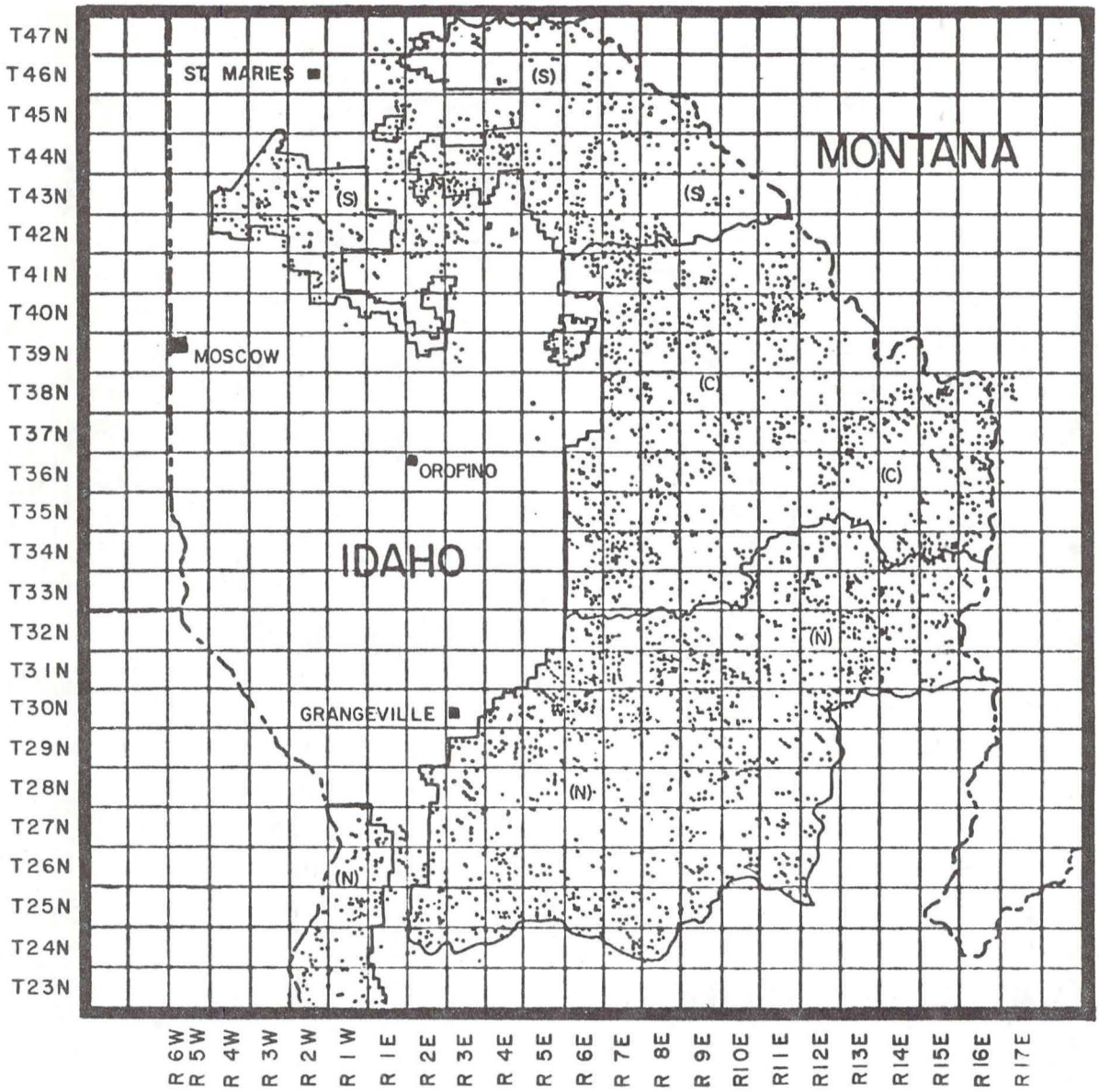

Figure II-3

LIGHTNING FIRE LOCATION: ST. JOE, CLEARWATER, AND NEZPERCE N.F., 1970-73

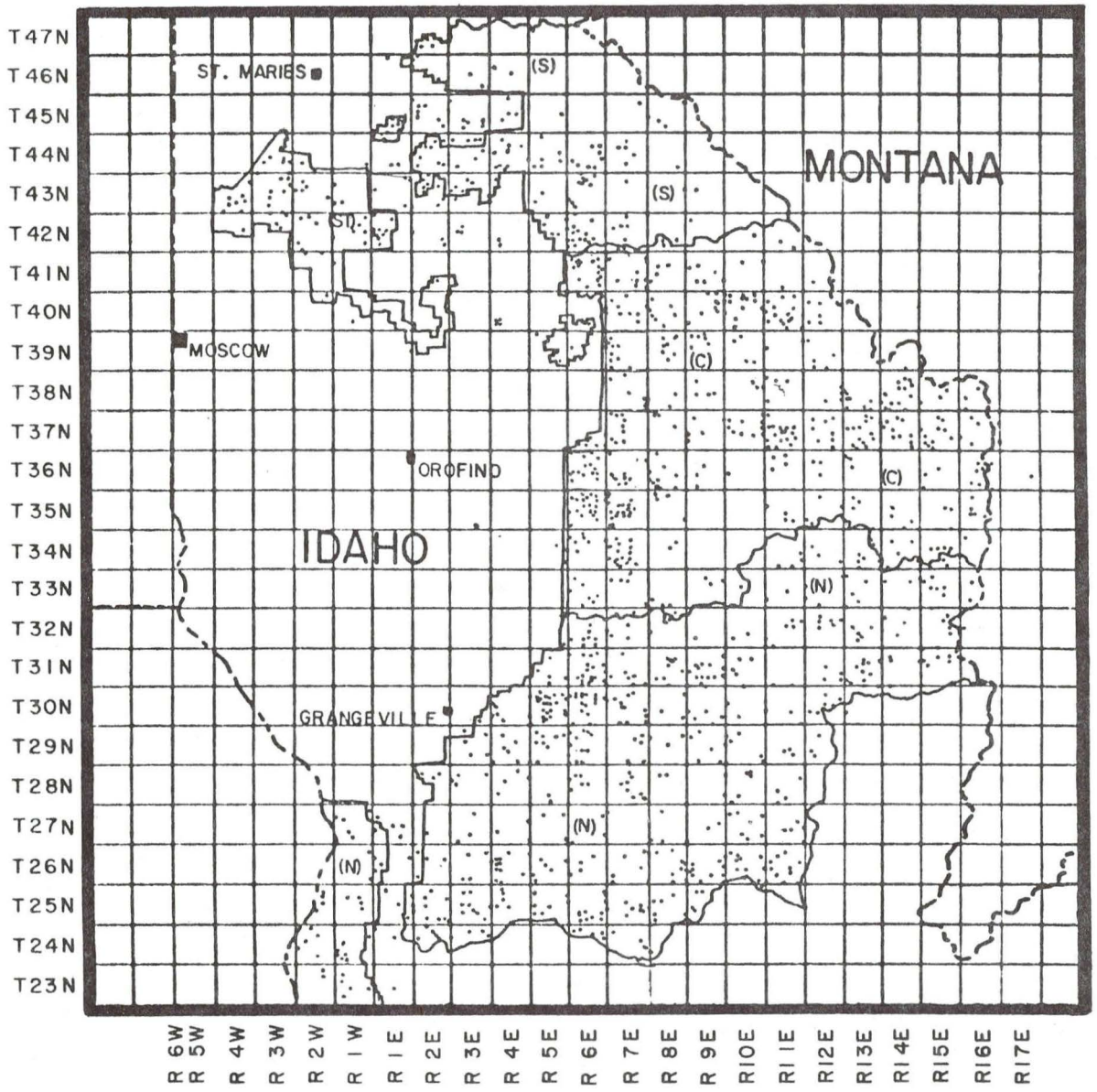

Figure II-4

LIGHTNING FIRE LOCATION: COLVILLE, KANIKSU, AND COUER D'ALENE NATIONAL FORESTS, 1960-69

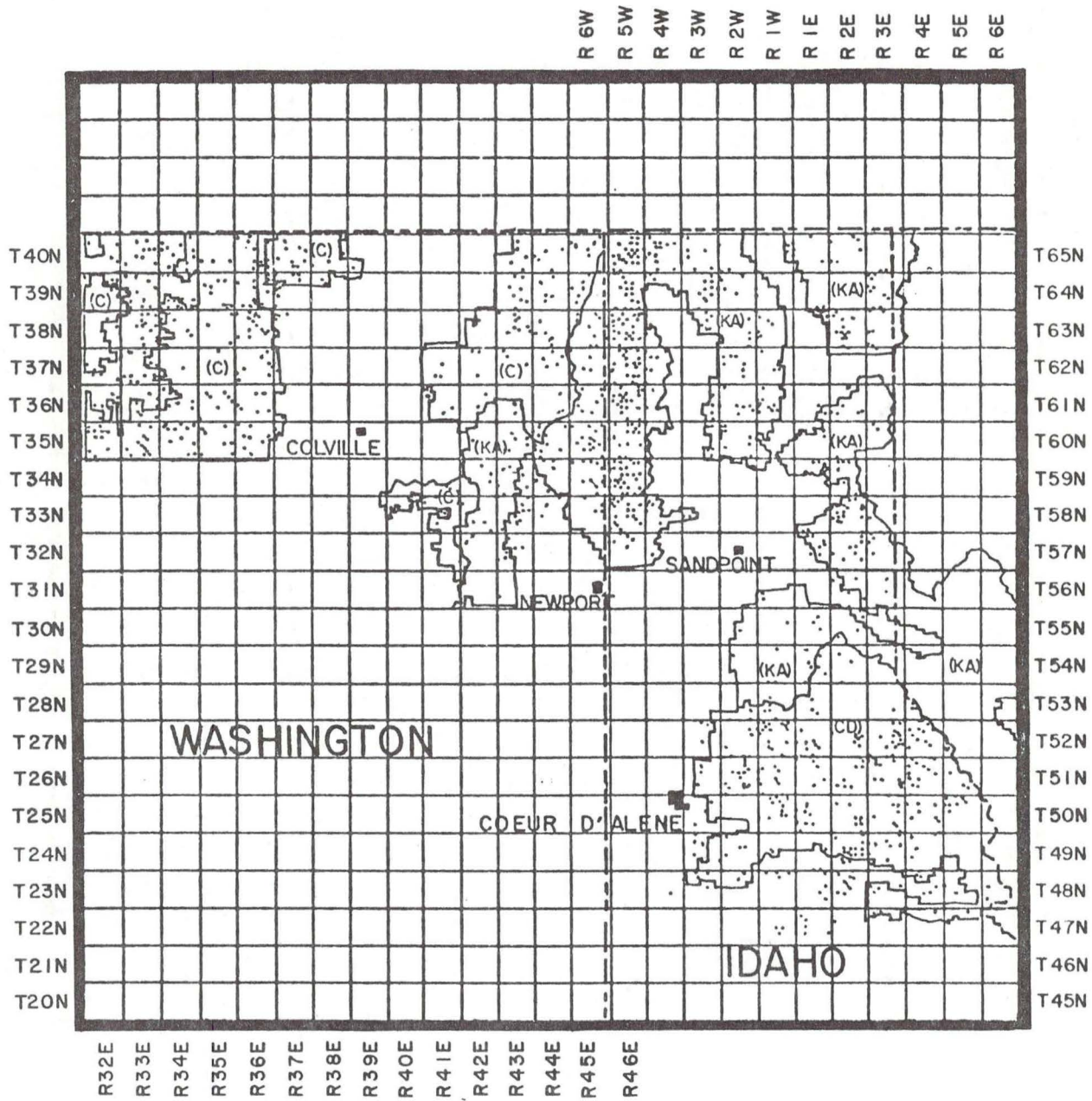

Figure II-5

LIGHTNING FIRE LOCATION: COLVILLE, KANIKSU, AND COUER D'ALENE NATIONAL FORESTS, 1970-73

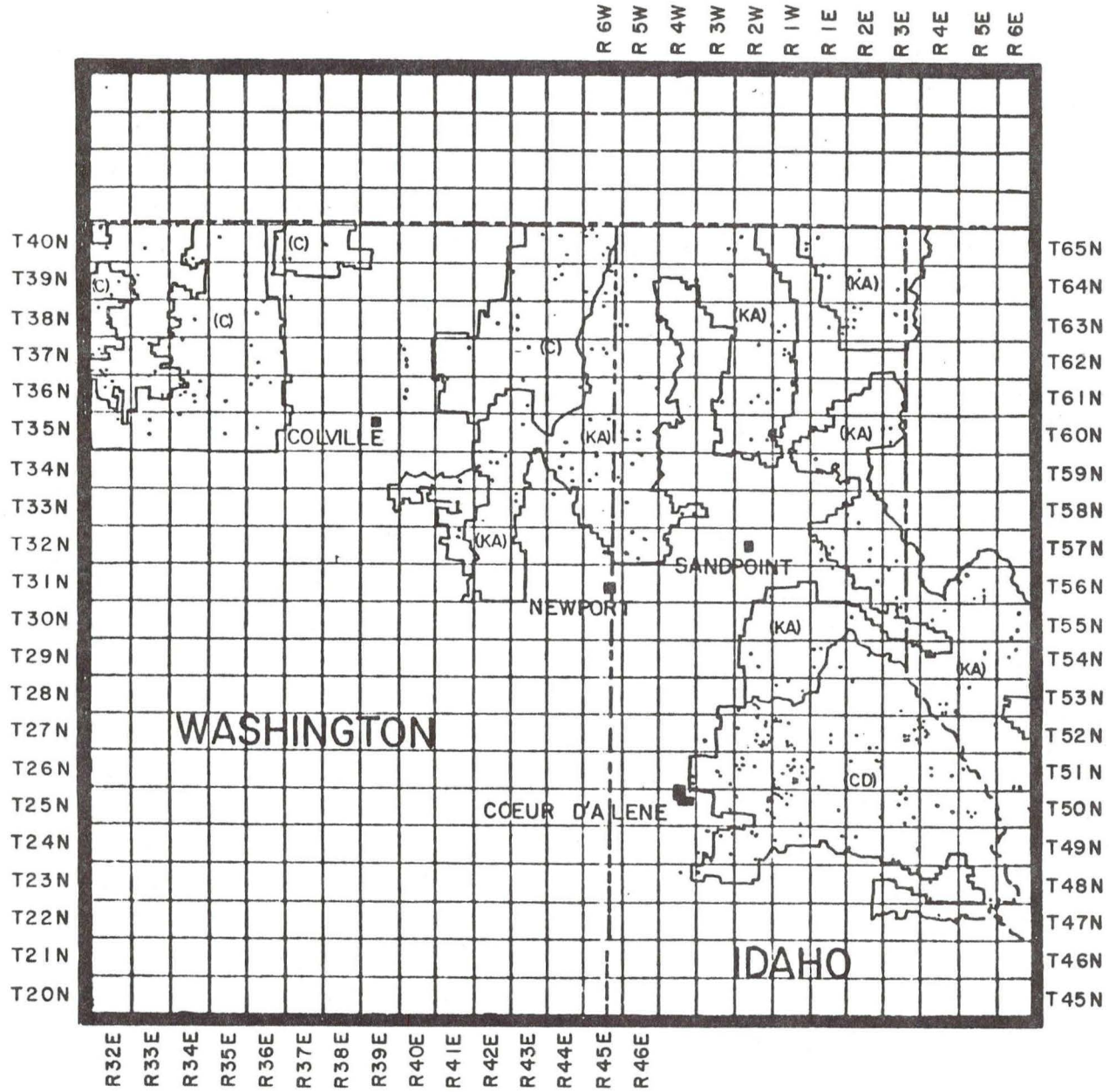

Figure II-6

LIGHTNING FIRE LOCATION: KANIKSU, KOOTENAI, AND COEUR D'ALENE NATIONAL FORESTS, 1960-69

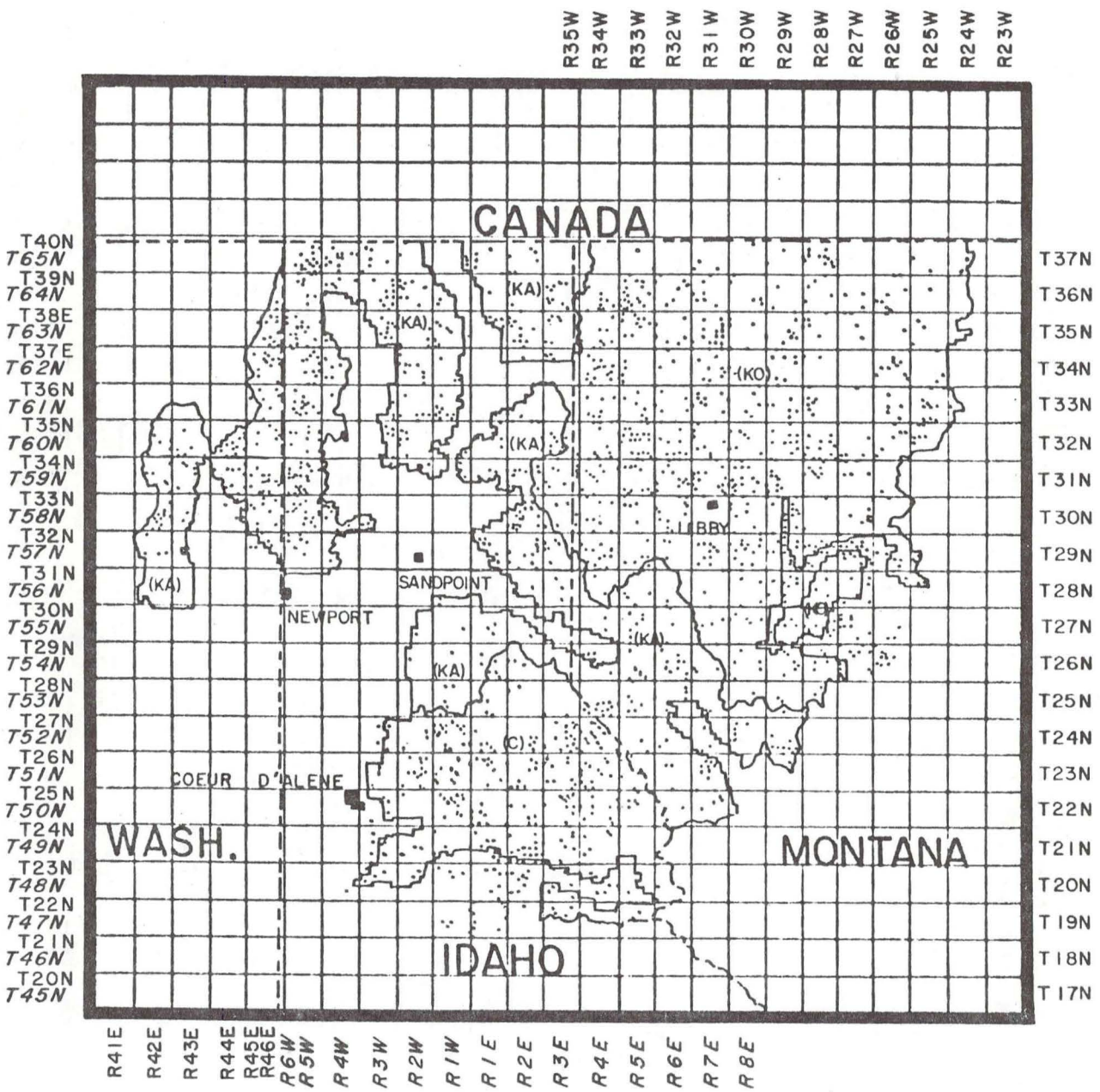

Figure II-7

LIGHTNING FIRE LOCATION: KANIKSU, KOOTENAI, AND COEUR D'ALENE NATIONAL FORESTS, 1970-73

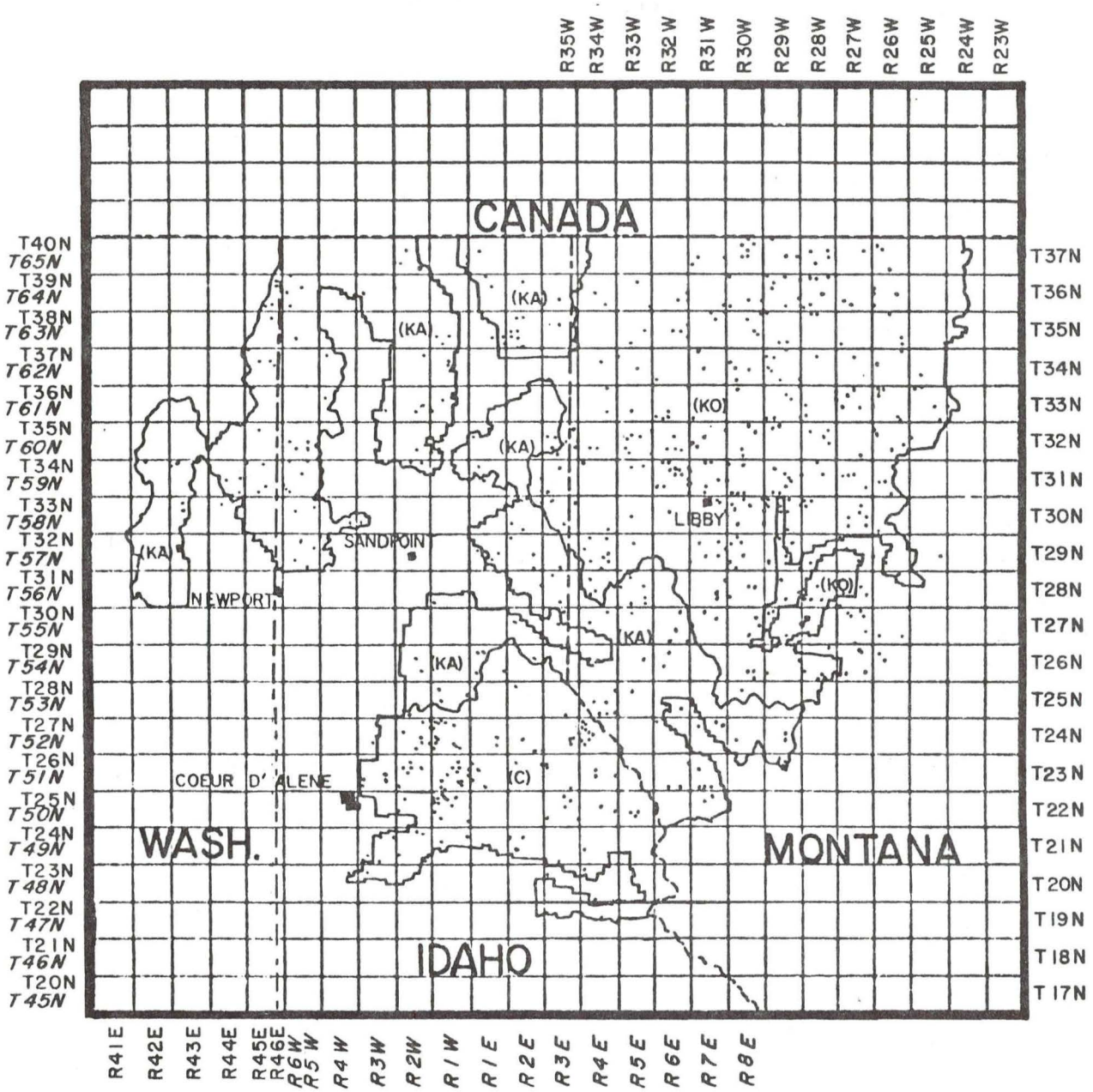

Figure II-8

LIGHTNING FIRE LOCATION: KOOTENAI AND FLATHEAD NATIONAL FORESTS, 1960-69

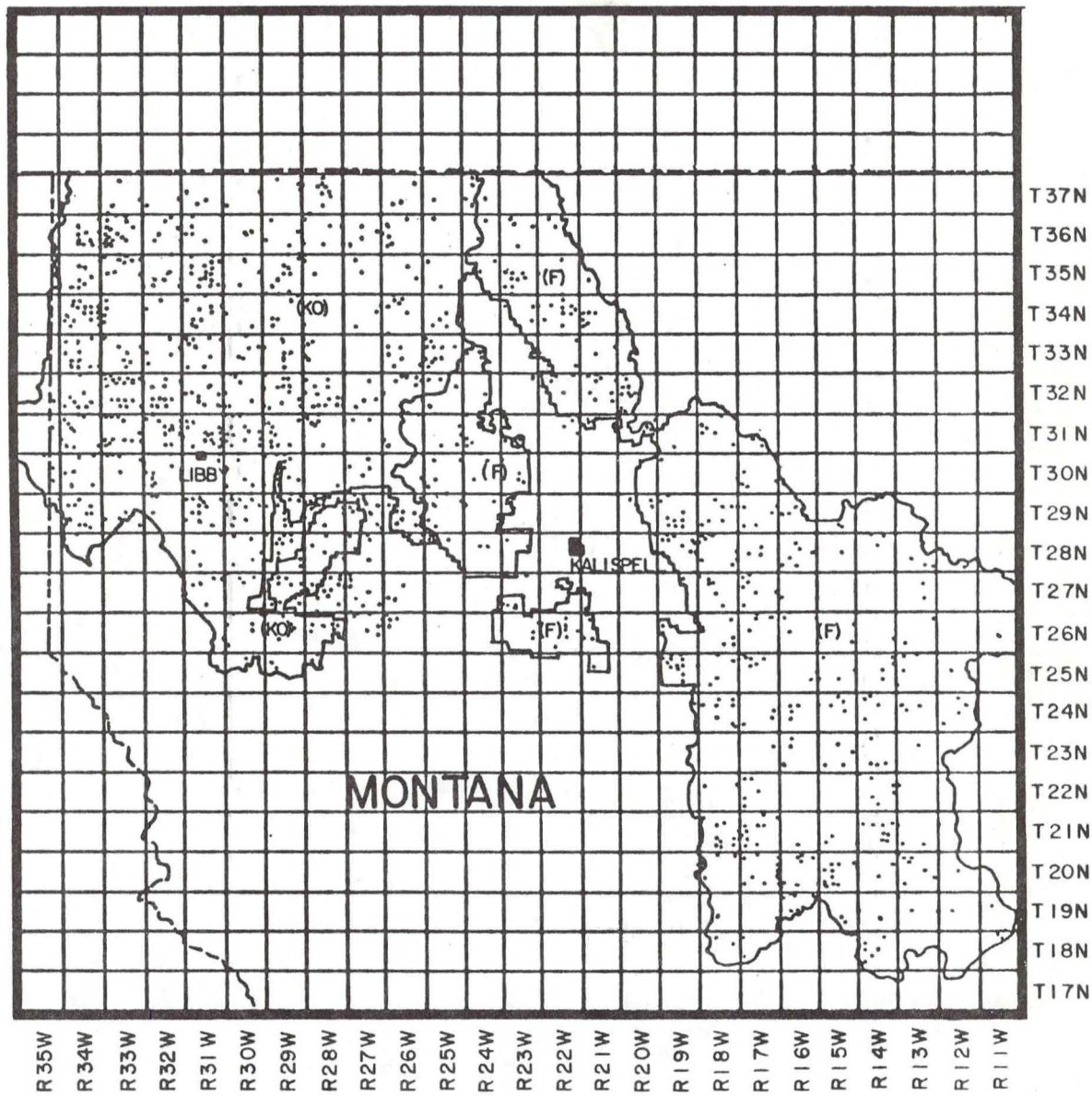

Figure II-9

LIGHTNING FIRE LOCATION: KOOTENAI AND FLATHEAD NATIONAL FORESTS, 1970-73

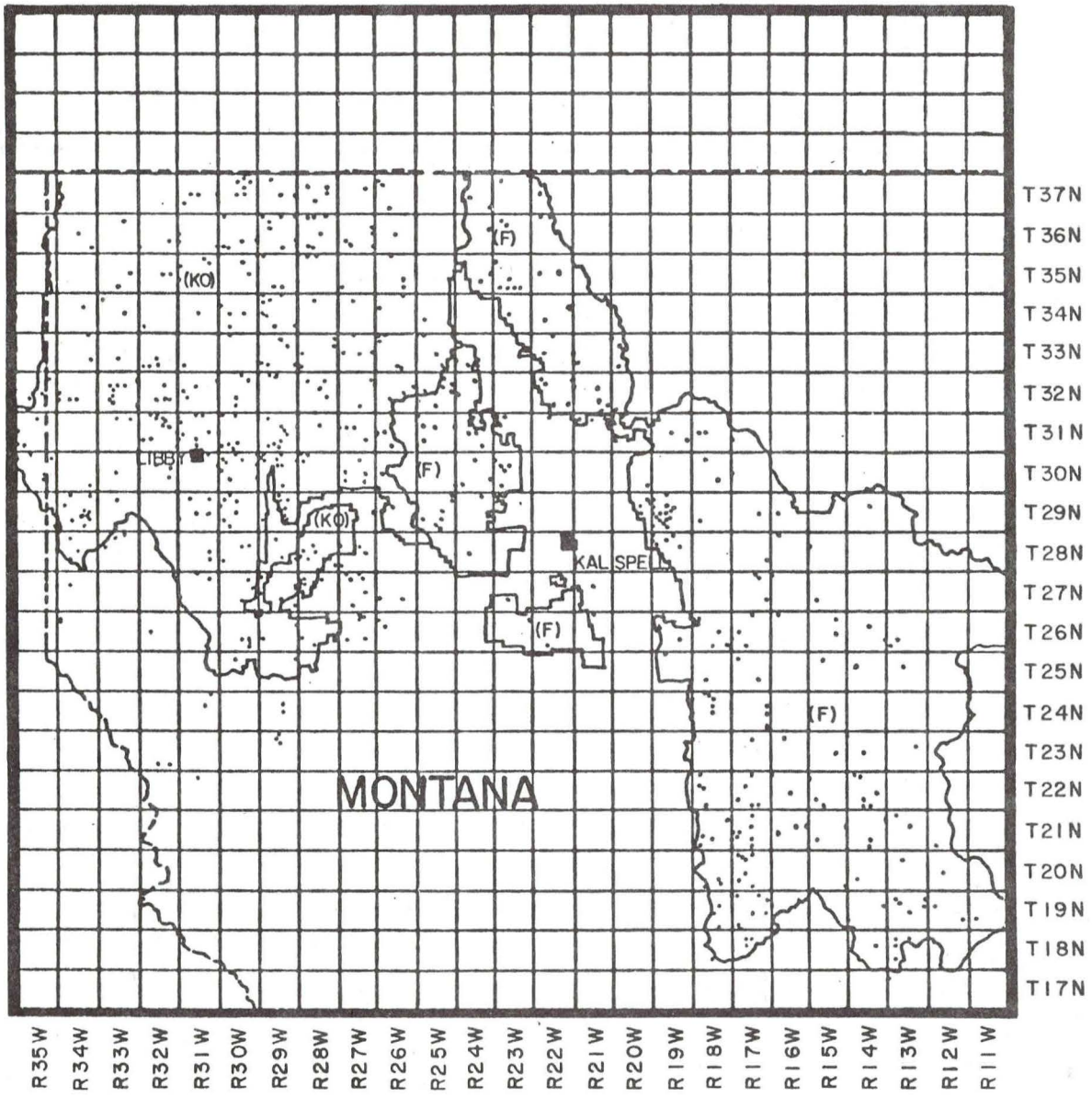

Figure II-10

LIGHTNING FIRE LOCATION:

LOLO NATIONAL FOREST, 1960-69

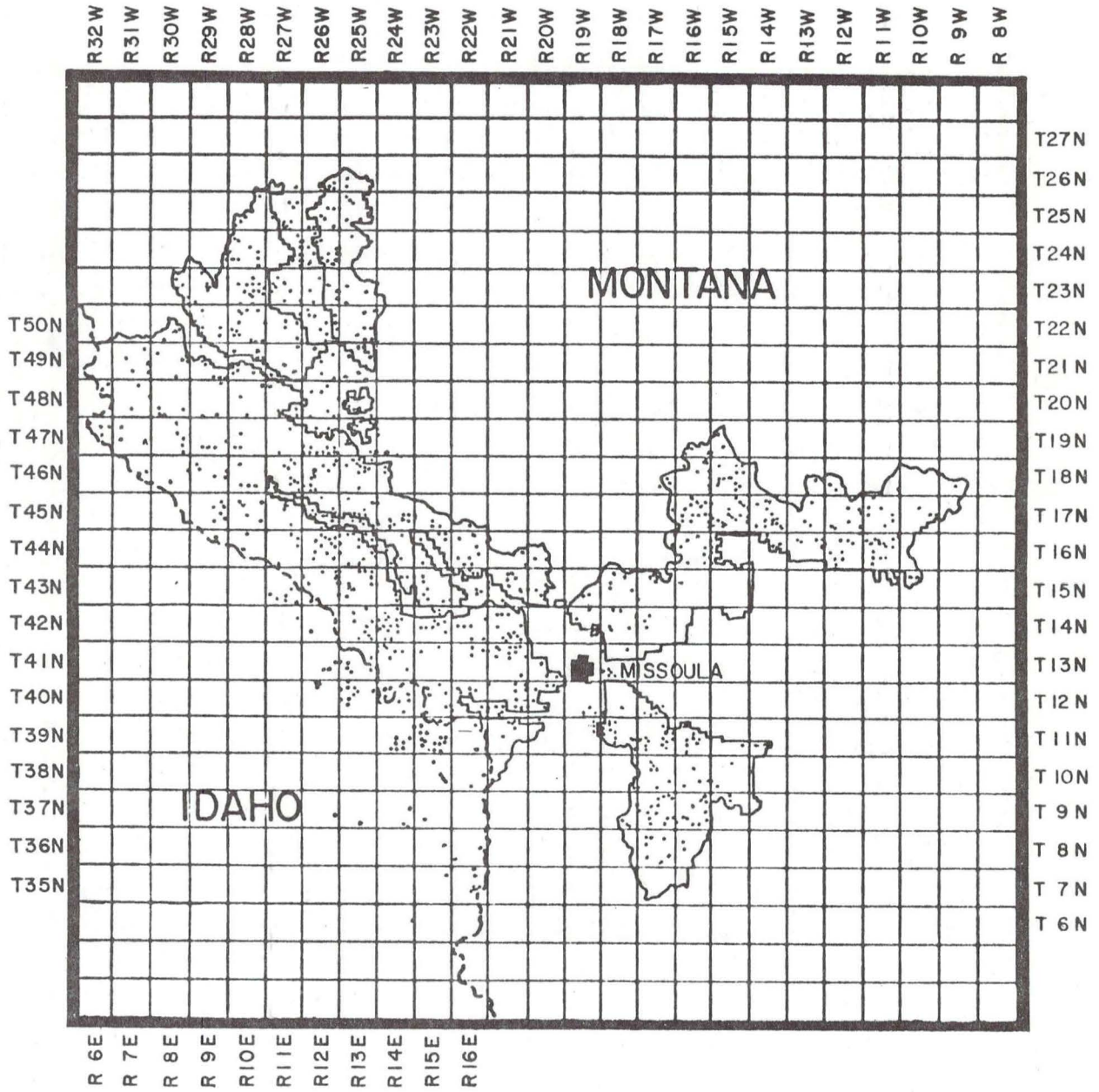

Figure II-11

LIGHTNING FIRE LOCATION:

LOLO NATIONAL FOREST, 1970-73

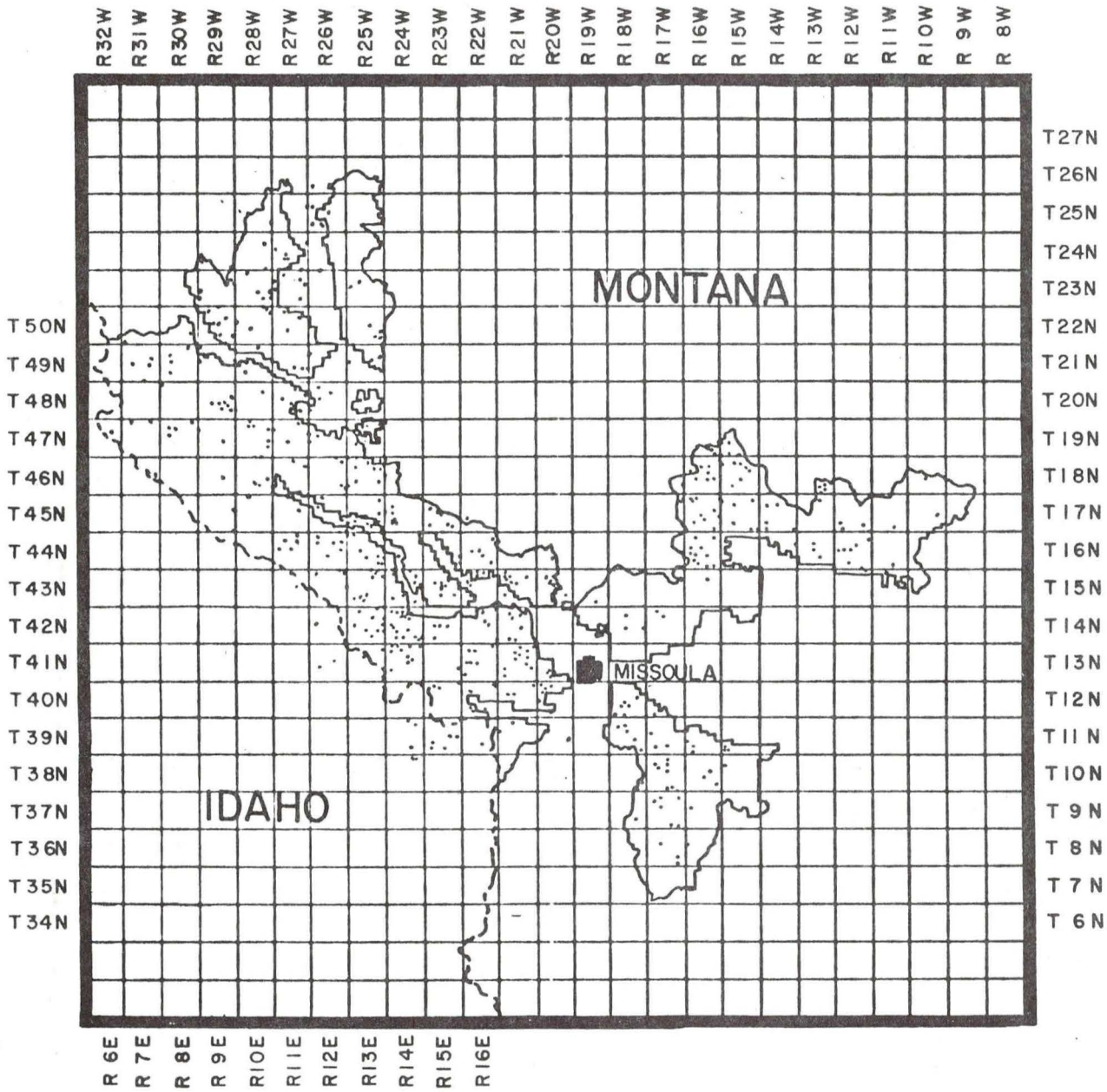

Figure II-12

LIGHTNING FIRE LOCATION: LEWIS AND CLARK AND HELENA NATIONAL FORESTS, 1960-69

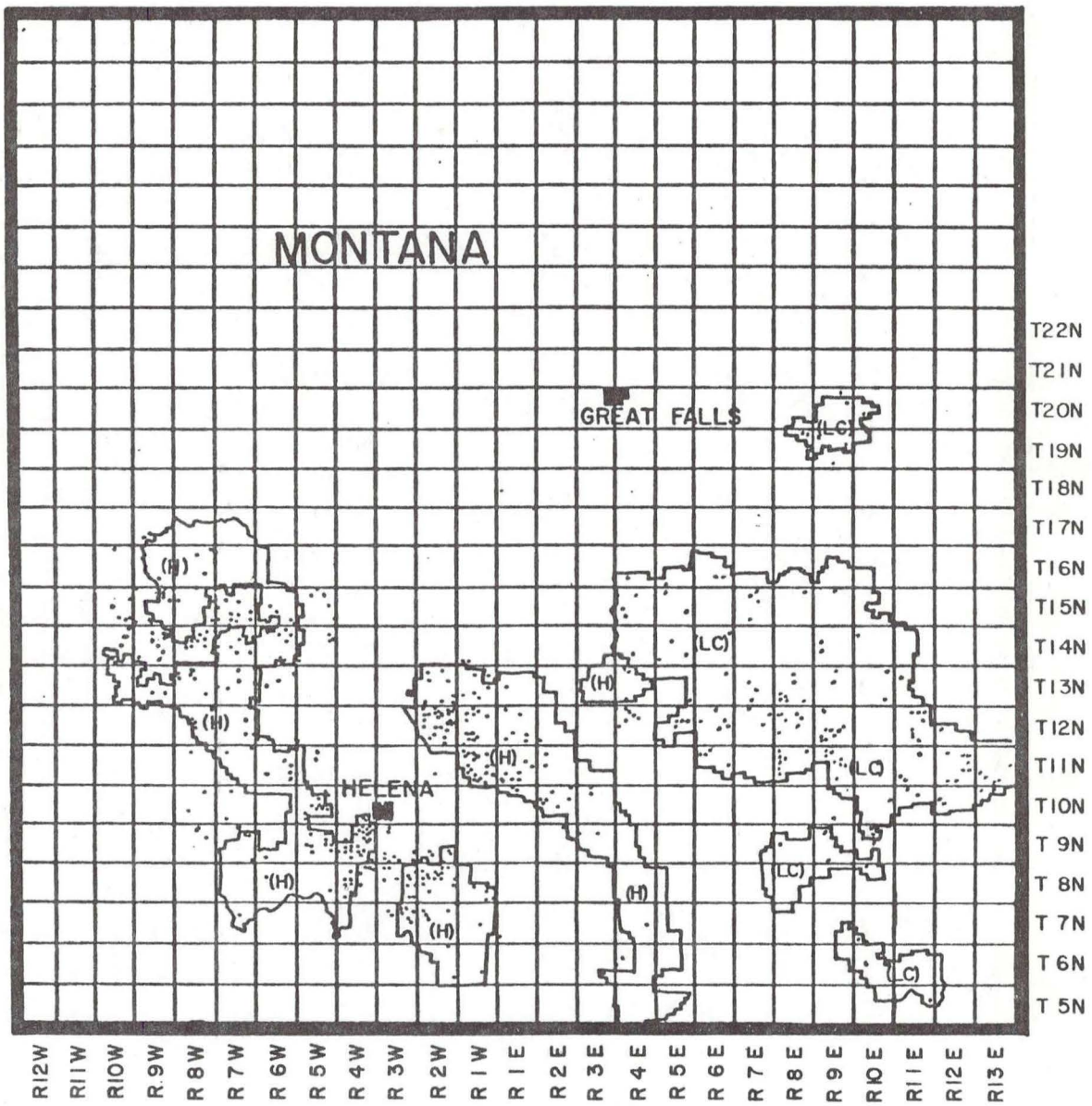

Figure II-13

LIGHTNING FIRE LOCATION: LEWIS AND CLARK AND HELENA NATIONAL FORESTS, 1970-73

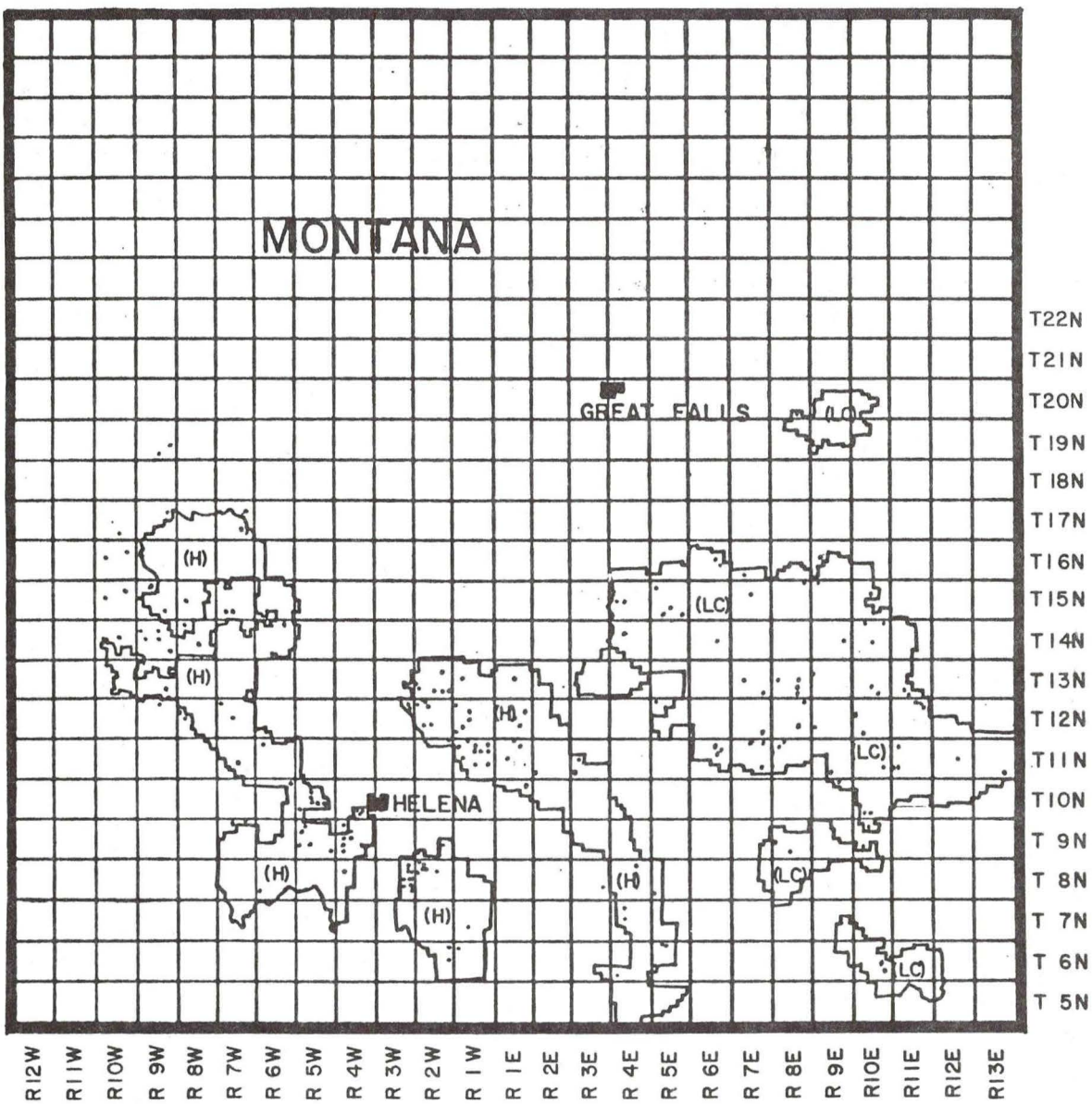

Figure II-14

LIGHTNING FIRE LOCATION: LEWIS AND CLARK NATIONAL FOREST (EAST), 1960-69

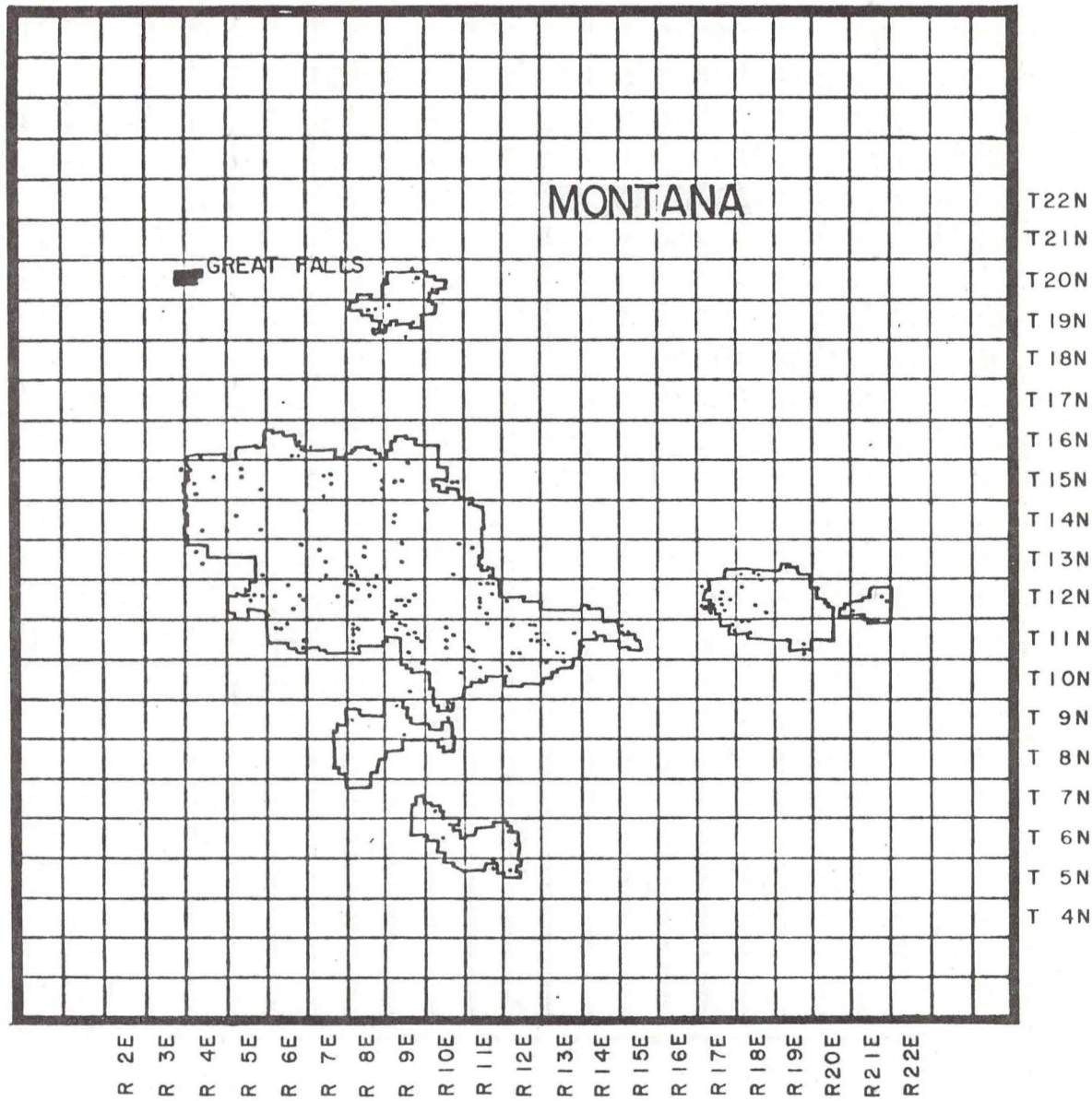

Figure II-15

LIGHTNING FIRE LOCATION: LEWIS AND CLARK NATIONAL FOREST(EAST), 1970-73

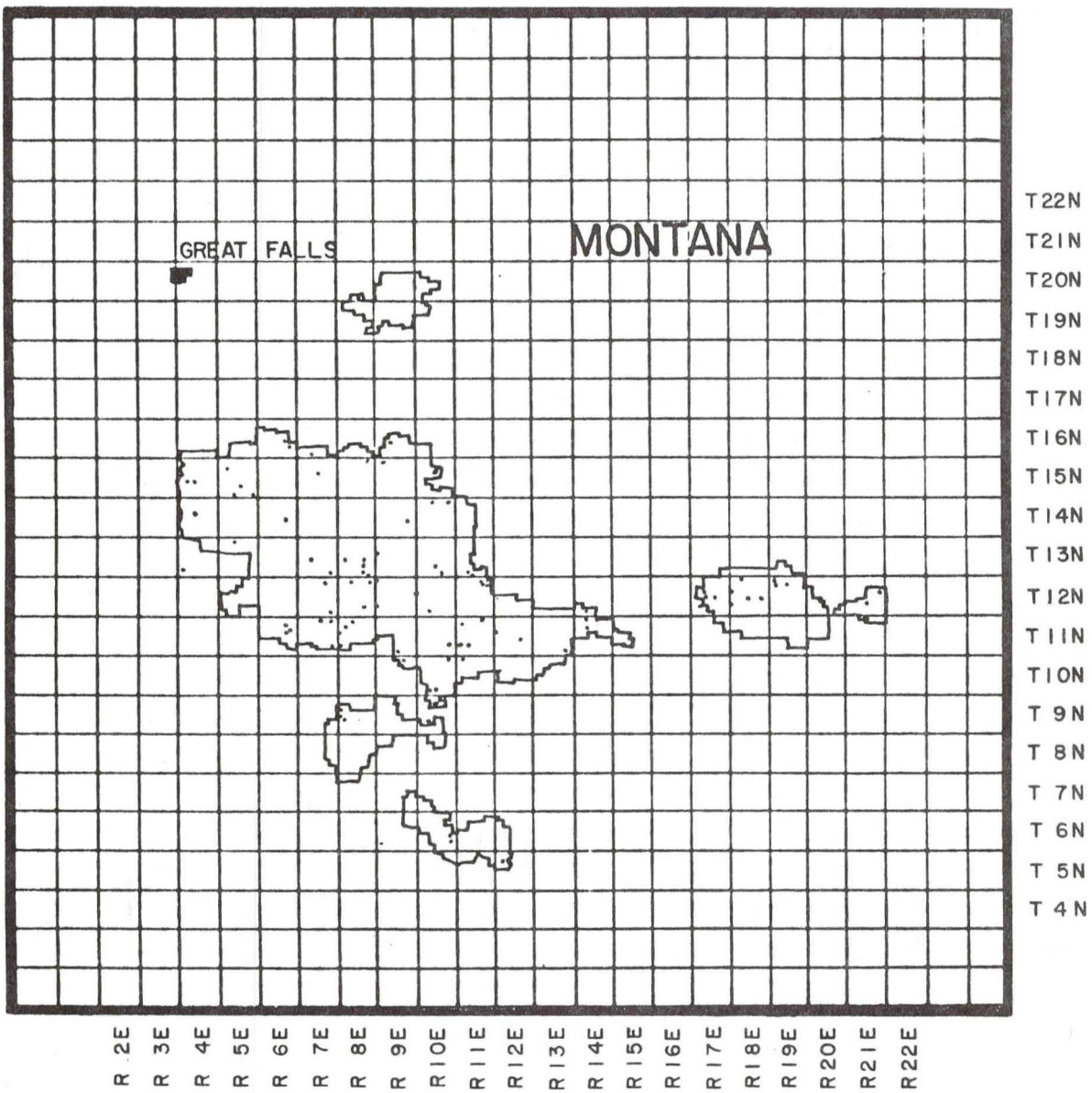

Figure II-16

LIGHTNING FIRE LOCATION: BEAVERHEAD AND DEERLODGE NATIONAL FORESTS, 1960-69

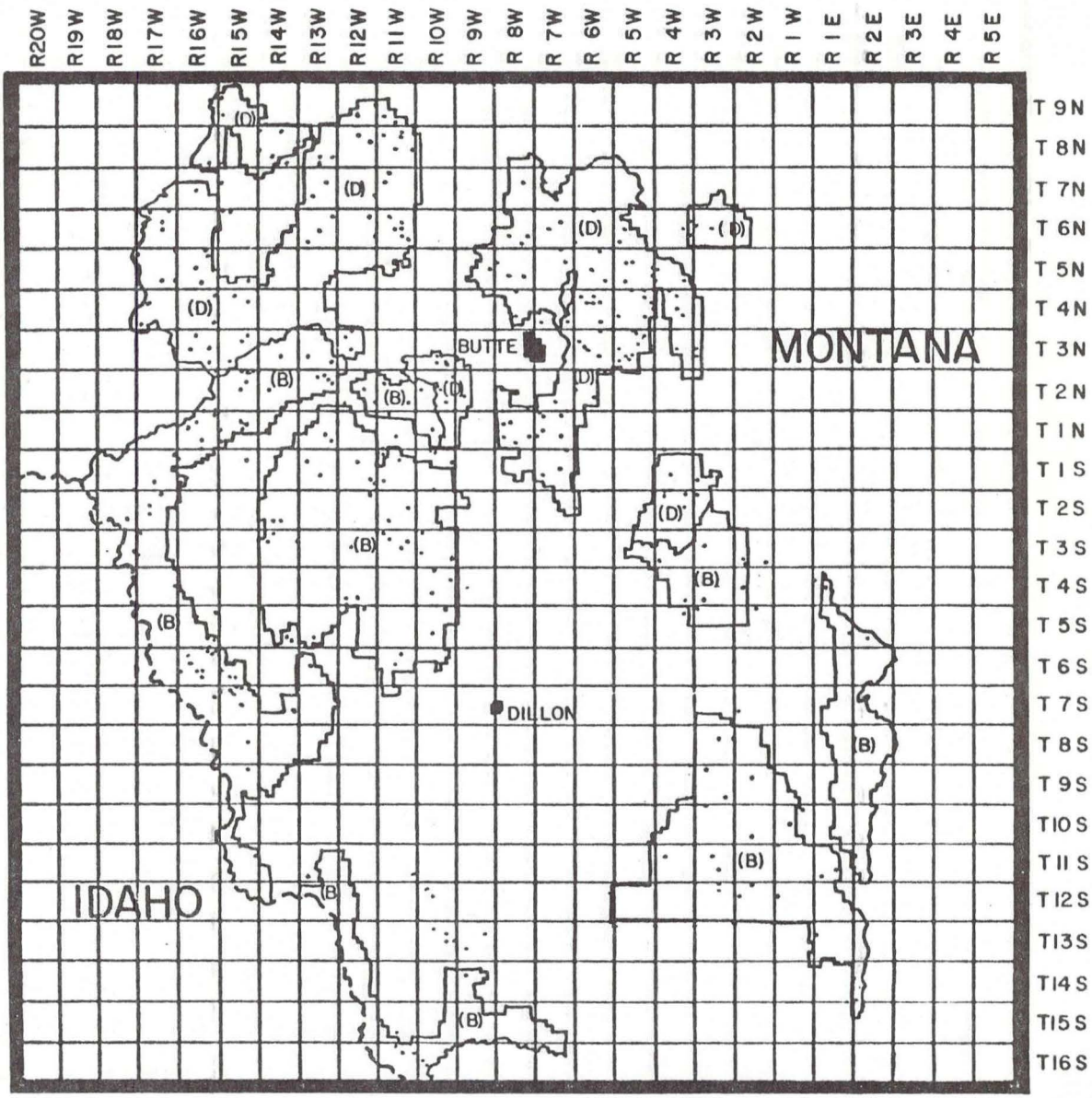

Figure II-17

LIGHTNING FIRE LOCATION: BEAVERHEAD AND DEERLODGE NATIONAL FORESTS, 1970-73

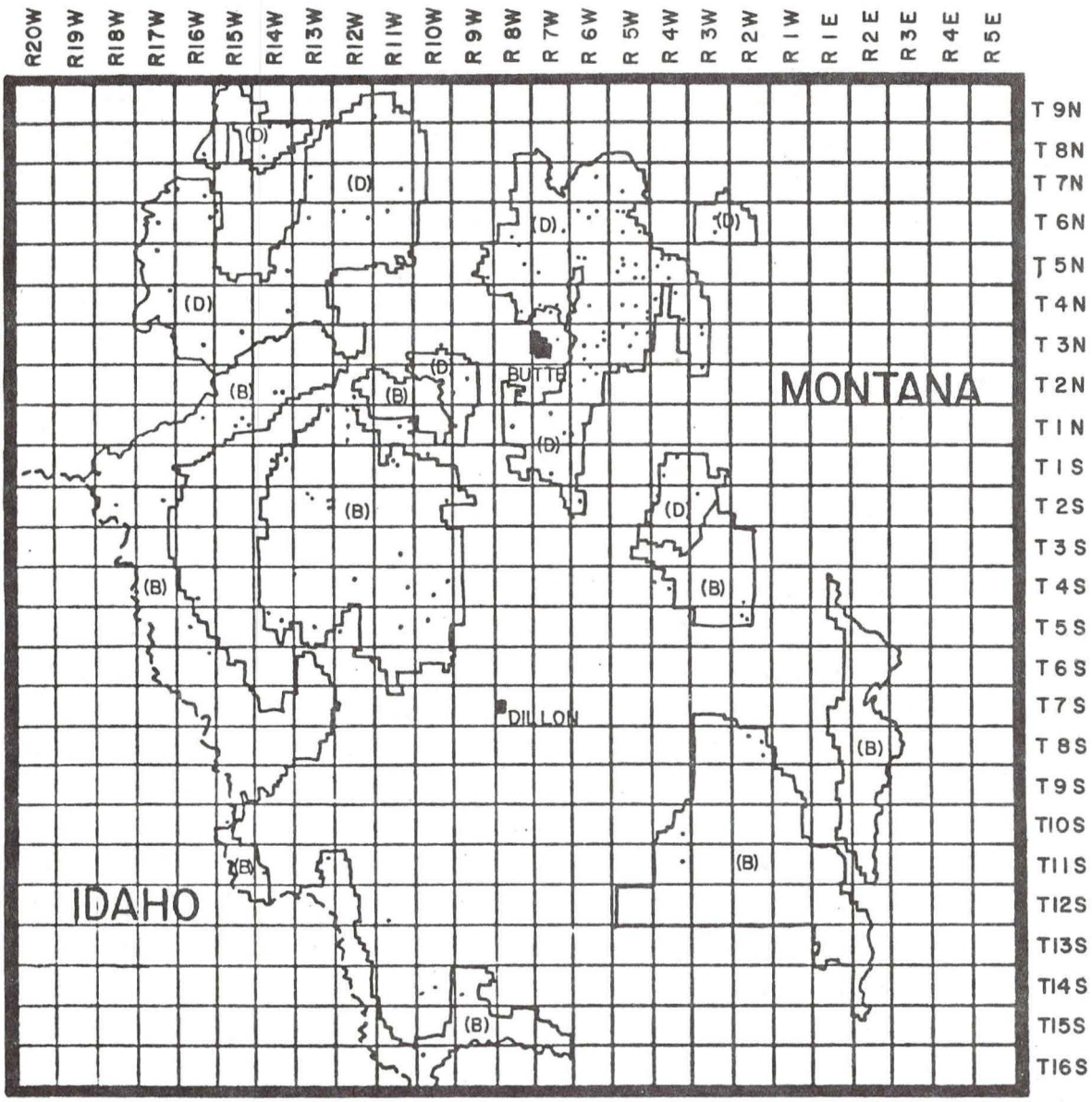

Figure II-18

LIGHTNING FIRE LOCATION: GALLATIN AND CUSTER NATIONAL FORESTS, 1960-69

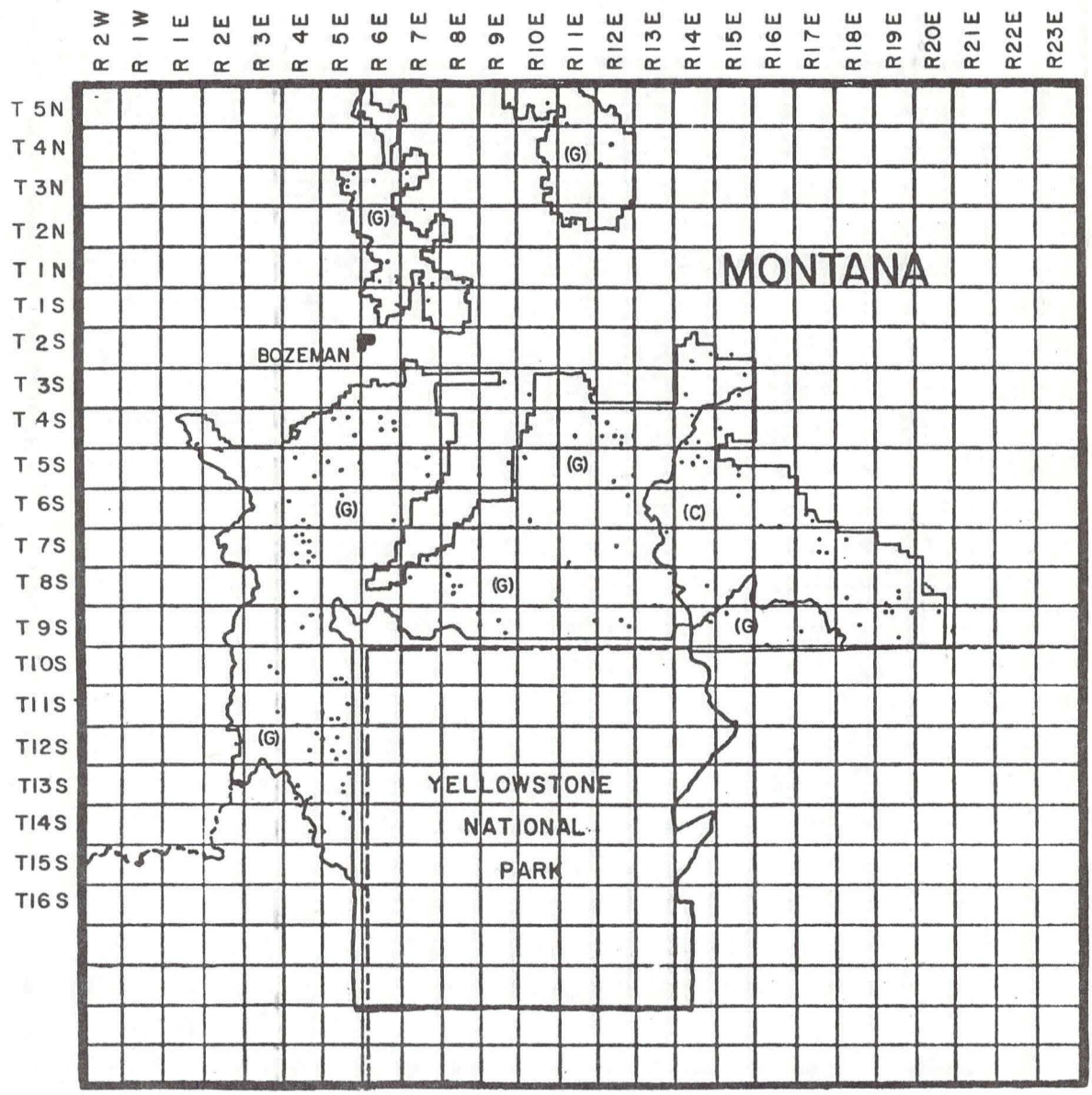

Figure II-19

LIGHTNING FIRE LOCATION: GALLATIN AND CUSTER NATIONAL FOREST, 1970-73

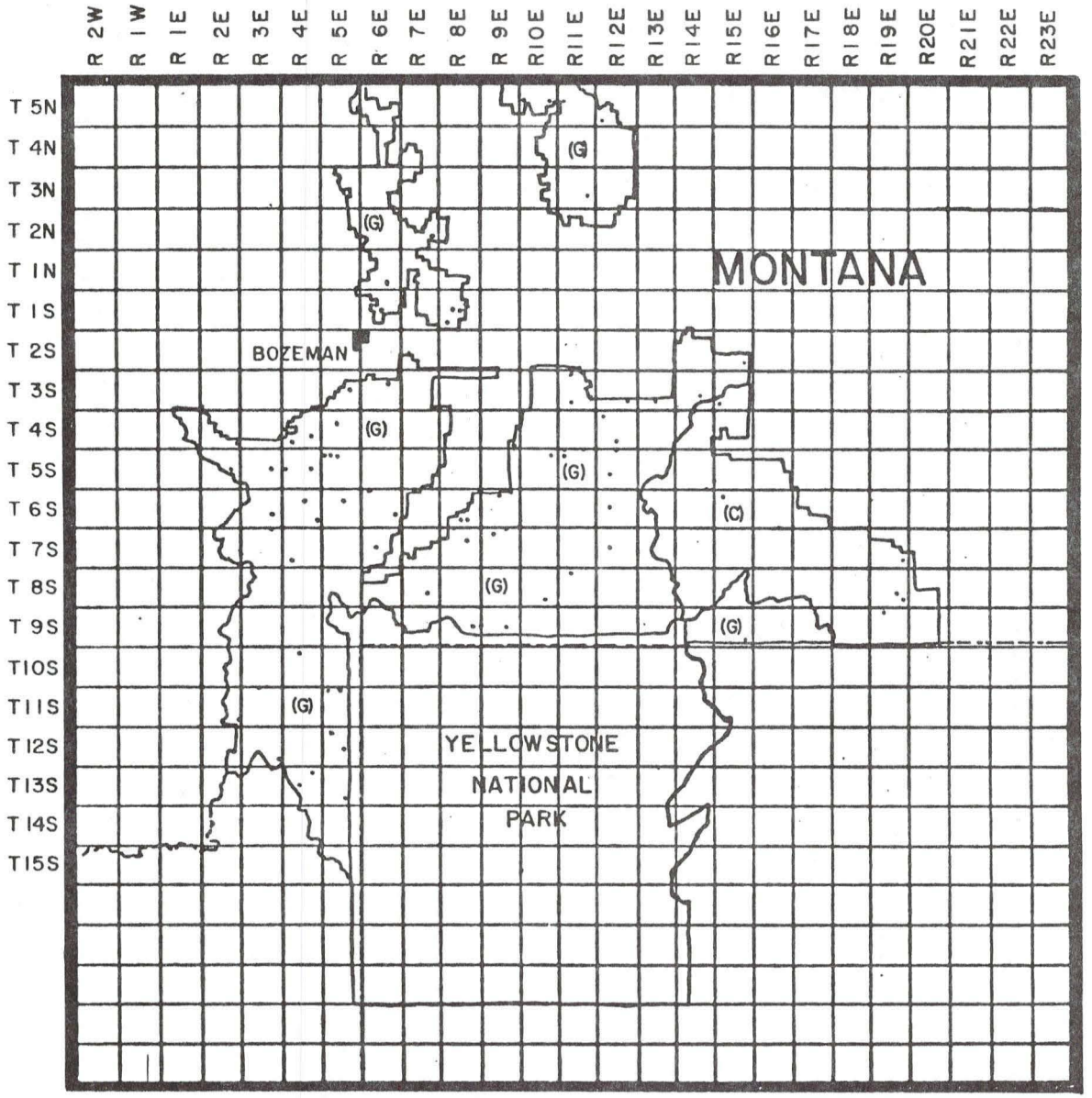

Figure II-20

LIGHTNING FIRE LOCATION: CUSTER NATIONAL FOREST (MIDDLE), 1960-69

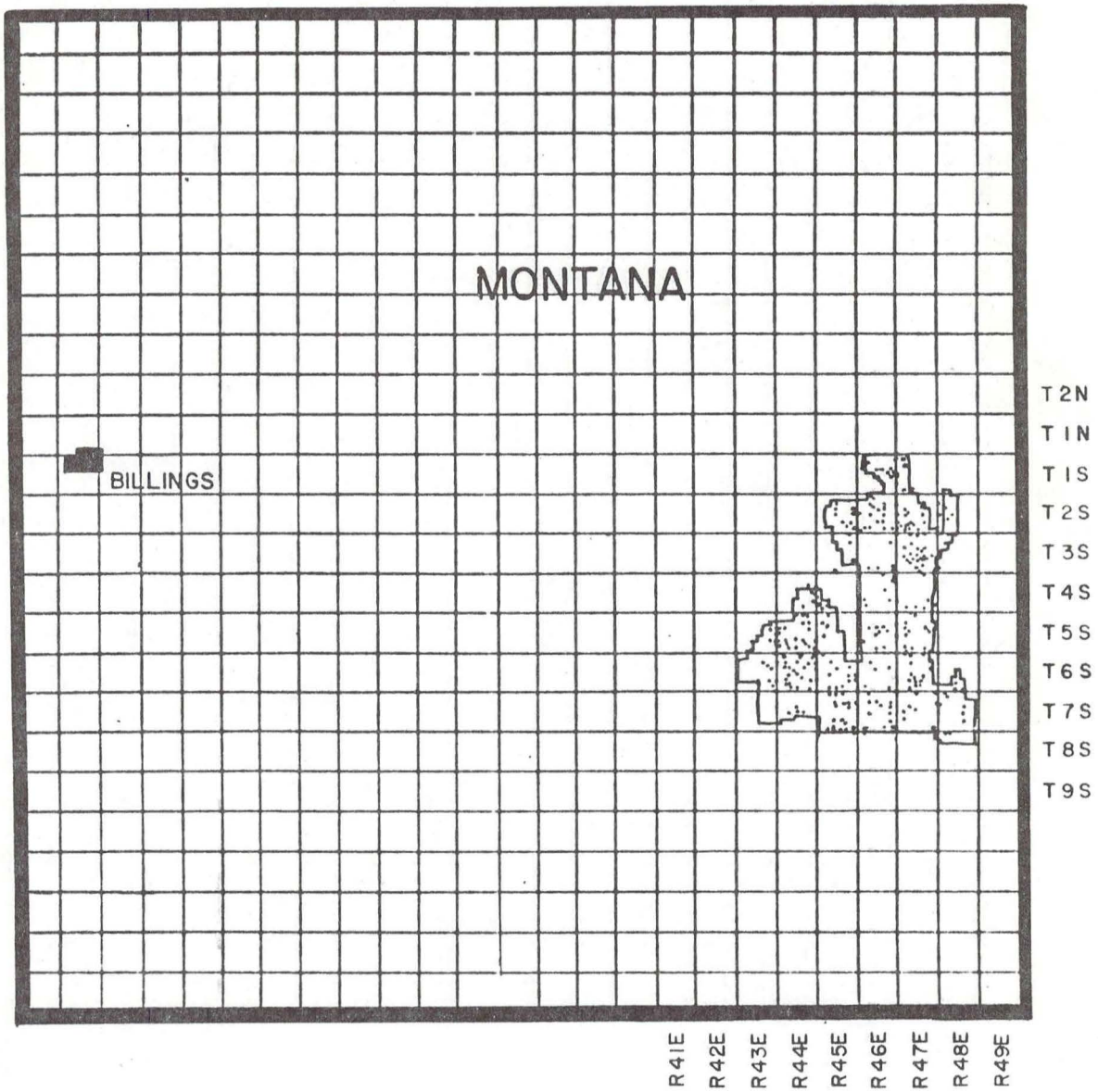

Figure II-21

LIGHTNING FIRE LOCATION: CUSTER NATIONAL FOREST (MIDDLE), 1970-73

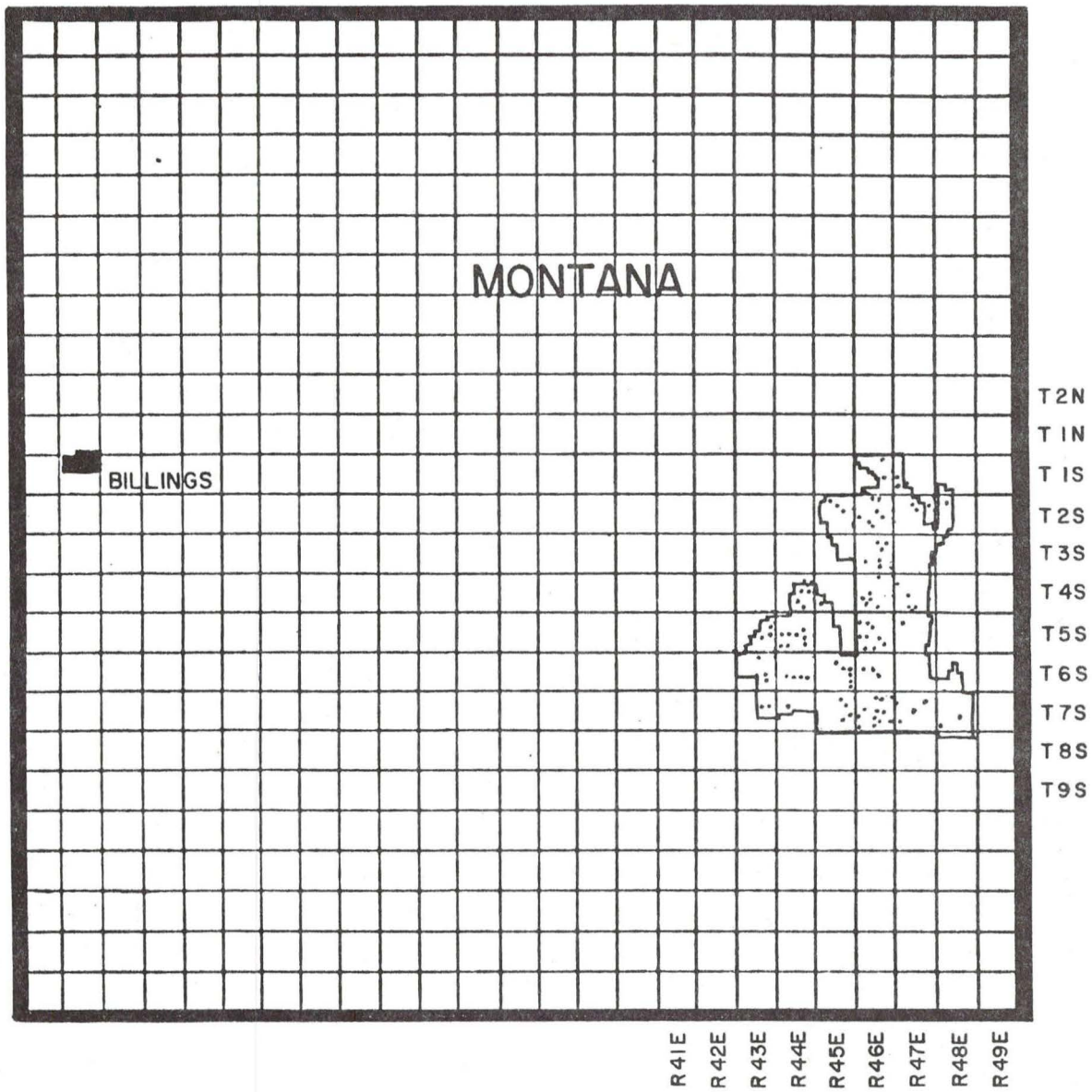

Figure II-22

LIGHTNING FIRE LOCATION: CUSTER NATIONAL FOREST (EAST), 1960-69

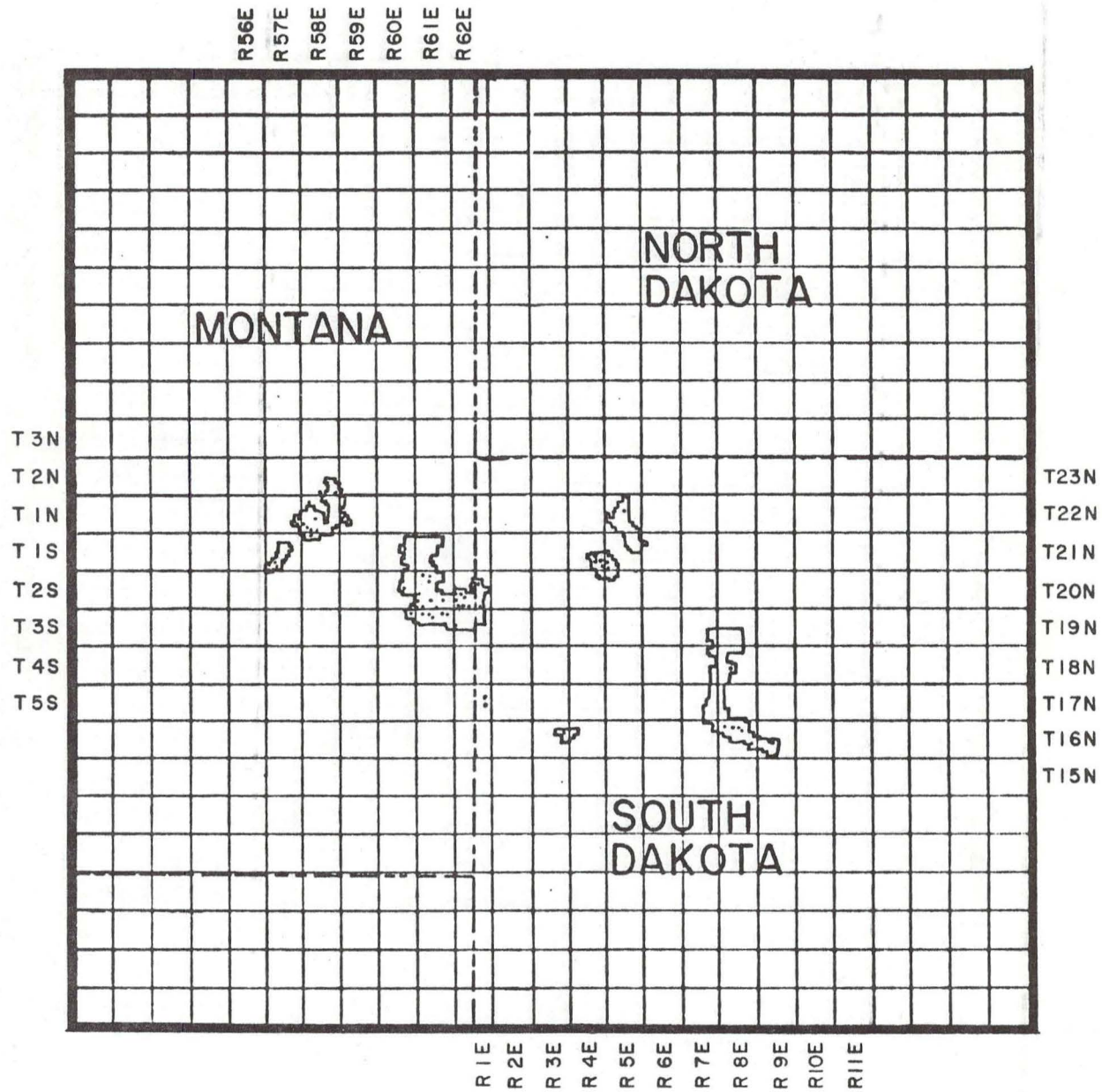

Figure II-23

LIGHTNING FIRE LOCATION: CUSTER NATIONAL FOREST (EAST), 1970-73

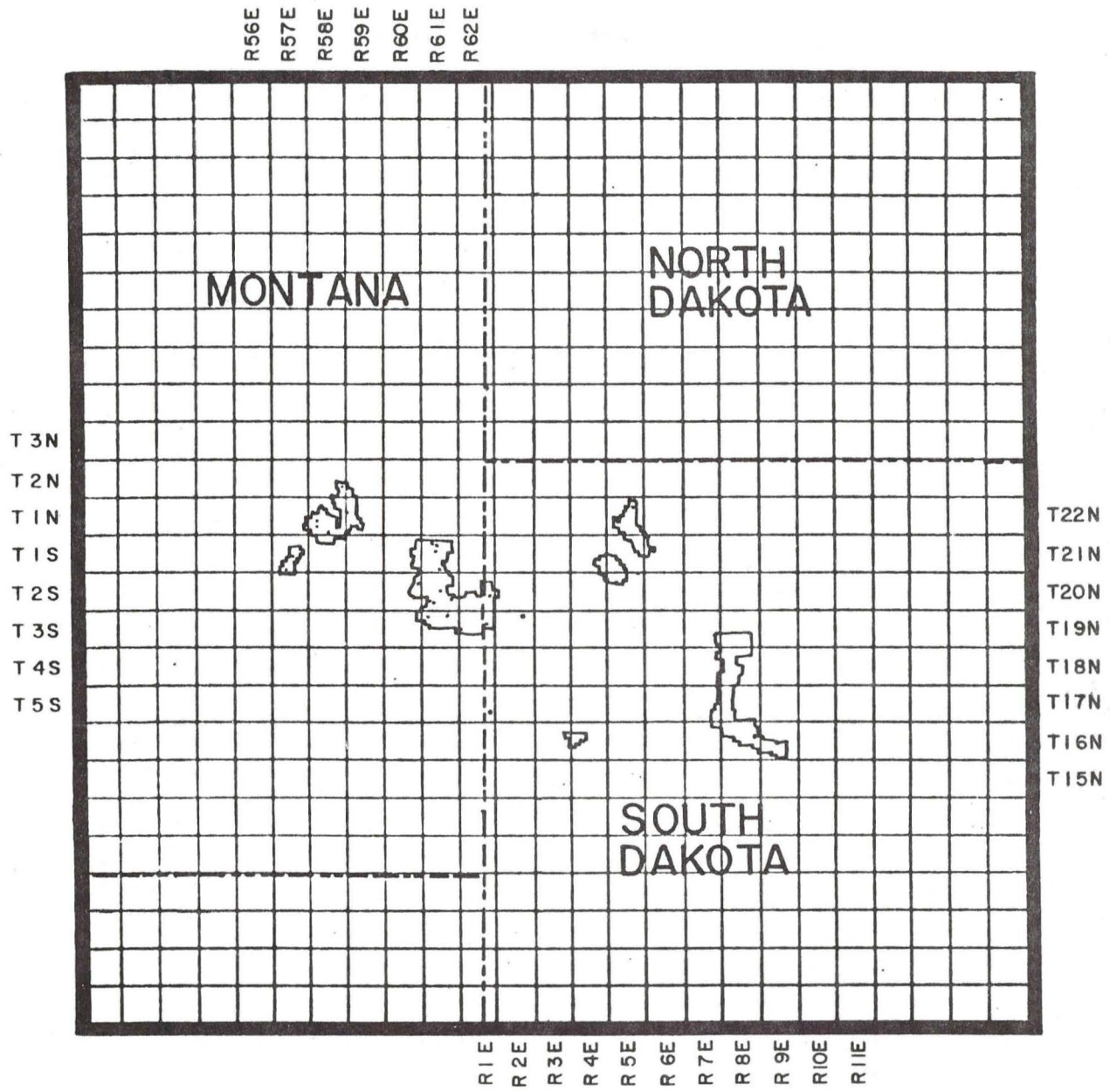

Figure II-24

II-2. Size Class of Fires and Area Burned

In this part of the analysis consideration is given to factors influencing fire load following the occurrence of a fire. The ignition of a fire immediately creates a fire load factor in terms of decision requirements, manpower and other control resource commitments. The continuing influence of this fire depends both upon its behavior and the actions of the fire management forces. Analysis of the size class of fires and area burned in specific time periods and locations provides important insight into the nature of the overall lightning fire load.

Size Class of Fires

More than four-fifths of the lightning fires in Region One are less than one-fourth acre or Class A in size.[1/] During the 1946-1973 period a total of 22,055 Class A fires occurred in Region One national forests (Table II-12). This amounts to 82.13 percent of the total lightning fires. Annual average occurrence is 788 Class A fires. Specific data on suppression manpower requirements for these Class A fires is not available. [However experience indicates that an average of 2.5 personnel and 1.9 days per fire (including travel, suppression and mop-up) may be required.] These estimates indicate an annual average of some 4700 man-days per fire season on Class A fires exclusive of detection, follow-up patrol, service of supply and supervision requirements.

At least one-fifth of all lightning fires exhibit growth potential. While 82.13 percent of all fires are held to Class A size many of these fires undoubtedly did not grow to a larger size because of effective control action. Whatever the attack may have been 17.87 percent of all lightning fires in Region One reached Class B or larger size during the 1946-1973 period (Table II-12). These, along with some Class A fires, are the ones with definite growth potential. An average of 15.50 percent of the fires in the region were held to Class B size. This is a remarkable demonstration of control action and has a significant impact in reducing the potential fire load. The Class B fire record indicates that an annual average of 87 percent of the fires exhibiting definite growth potential were held to less than 10 acres in size.

1/ Acres in each size class of fire are: A - less than .25; B - .25 to 9.99; C - 10.0 to 99.99; D - 100.00 to 299.99; E - 300 to 999.99; F - 1,000.00 to 4999.99; G - 5,000 or more. In this study Class E+ is used to indicate all fires of 300 acres or more.

Table II-12. Annual Distribution of Lightning Fires By Size Class, Region One National Forests, 1946-1973.

	A	B	C	D	E+[1]	Total	% Class C or Larger
1946	1099	217	22	4	3	1345	
1947	1102	214	22	5	2	1345	
1948	255	19	0	0	0	274	
1949	1106	224	23	6	6	1365	
Sub Total	3562	674	67	15	11	4329	
4 Year Ave	890.5	168.5	16.8	3.8	2.8	1082.3	2.14
1950	468	57	1	3	0	529	
1951	644	118	11	1	1	775	
1952	523	101	6	0	0	630	
1953	983	312	49	9	4	1357	
1954	507	68	4	0	1	580	
Sub Total	3125	656	71	13	6	3871	
5 Year Ave.	625.0	131.2	14.2	2.6	1.2	774.2	2.32
1955	534	75	9	3	2	623	
1956	778	127	24	7	1	937	
1957	625	122	7	1	0	755	
1958	913	141	11	5	1	1071	
1959	453	101	11	0	2	567	
Sub Total	3303	566	62	16	6	3953	
5 Year Ave.	660.6	113.2	12.4	3.2	1.2	790.6	2.12
1960	721	237	31	8	6	1003	
1961	1650	334	47	10	13	2054	
1962	769	134	7	1	1	912	
1963	1373	195	12	0	2	1582	
1964	501	59	5	1	1	567	
Sub Total	5014	959	102	20	23	6118	
5 Year Ave.	1002.8	191.8	20.4	4.0	4.6	1223.6	2.37
1965	486	63	0	0	0	549	
1966	1007	178	36	5	9	1235	
1967	1093	276	38	6	13	1426	
1968	447	84	6	0	1	538	
1969	365	93	9	2	0	469	
Sub Total	3398	694	89	13	23	4217	
5 Year Ave.	679.6	138.8	17.8	2.6	4.6	843.4	2.96
1970	1216	171	25	2	4	1418	
1971	563	108	16	0	0	687	
1972	873	126	7	0	1	1007	
1973	1001	209	33	3	7	1253	
Sub Total	3653	614	81	5	12	4365	
4 Year Ave	913.3	153.5	20.3	1.3	3.0	1091.3	2.25
Grand Total	22055	4163	472	82	81	26853	
28 Year Ave	787.7	148.7	16.9	2.9	2.9	959.0	2.36
Percent	82.13	15.50	1.76	.31	.30		

(1) Includes all fires 300 acres or more in size

Less than three percent of the lightning fires in Region One reach Class C or larger size. During the 1946-1973 period a total of 635 fires or 2.36 percent of all lightning fires grew to sizes of 10 acres or more (Table II-12). These fires have the greatest impact on forest resources and account for more than 95 percent of the area burned. There is great variability by years in the number of Class C or larger fires. In 1948 and 1965 not a single lightning fire in Region One reached 10 acres in size. A total of 50 or more Class C or larger fires occurred in 1953, 1961, 1966 and 1967. The peak occurrence of 70 Class C or larger fires was recorded in 1961.

An average of six fires per year reach Class D or larger size. While these fires are less than one percent of the total number of fires they have great impact on the overall fire load (Table II-12). More than 50 percent of these big fires occurred in just five years (1953, 1960, 1961, 1966 and 1967) with the peak of 19 being recorded in 1967. A total of 163 Class D or larger fires occurred during the 28-year study period. A total of 81 of these fires grew to Class E or larger size as follows:

34 fires -- 300 to 999.99 acres

36 fires -- 1000 to 4499.99 acres

11 fires -- More than 5000 acres

Fires reaching 100 acres in size have a high potential for continued growth. This potential is strikingly illustrated by the big fire history during the 1946-1973 period:

(1) Of the fires reaching Class D size 49.69 percent continued on to Class E or larger size.

(2) Of the fires reaching Class E size 58.02 percent continued on to Class F size (1,000 to 4,499.99 acres).

(3) Of the fires reaching Class F size 23.40 percent continued on to Class G size (more than 5,000 acres).

Expressed in terms of betting odds, this means:

(1) When a fire becomes 100 acres in size the odds are about even that it will burn more than 300 acres.

(2) When a fire becomes 300 acres in size the odds are about 7 to 5 that it will burn more than 1,000 acres.

(3) When a fire becomes 1,000 acres in size the odds are about 2 to 7 that it will burn more than 5,000 acres (by no means long shot odds at the race track).

Western Zone national forests have a small percentage of Class C or larger size fires. During the 1946-1973 period, 361 fires or 1.61 percent reached these sizes. The Southwestern group with 178 class C or larger fires led the Western Zone. This group also led all other groups in number of Class E or larger fires. In this group 67 percent of the fires reaching Class D size continued on to Class E or larger size.

The Nezperce National Forest leads the Western Zone in Class C or larger fires. In the 28-year period this forest recorded 85 of these fires for 2.18 percent of the forest total. The Nezperce also led all Region One forests in Class E or larger fires with a total of 19. The big fire potential on this forest is vividly demonstrated by the fact that 70 percent of the fires reaching class D size continued on to Class E or larger size.

Eastern Zone national forests have a relatively high percentage of both Class B and Class C or larger size fires. During the 1946-1973 period, 26 percent of the fires in the Eastern Zone were Class B size as compared to only 13 percent in the Western Zone. The occurrence of Class

B fires is especially prevalent in the Southeastern group where 30 percent were in this size class (Table II-14). In the Eastern Zone, 6.17 percent of the fires reached Class C or larger size. The Southeastern group led all other groups with 8.13 percent Class C or larger size fires. In the Eastern Zone, 40 percent of the fires reaching Class D size continue on to a larger size.

The Custer National Forest leads Region One in Class C or larger fires. As shown in Table II-14 the Custer recorded 125 Class C or larger fires (11.48 percent of the forest total). The forest led Region One in number of Class C and D fires with 93 and 19 respectively. The Total of 13 Class E or larger fires was second only to the Nezperce forest.

Table II-13. Number of Lightning Fires by Size Class in Western Zone National Forests, Region One, 1946-1973.

Group and National Forest	Size Class of Fires A	B	C	D	E+	Total	% Class C or Larger
Southwestern							
Bitterroot	2316	408	45	5	8	2782	2.08
Clearwater	2247	304	24	4	7	2586	1.35
Nezperce	3279	535	58	8	19	3899	2.18
Group Total	7842	1247	127	17	34	9267	1.92
Northwestern							
Coeur'd Alene	994	128	8	1	0	1131	0.80
Colville	857	130	11	0	1	999	1.20
Kaniksu	1609	212	16	3	5	1845	1.30
St. Joe	1739	208	13	2	2	1964	0.87
Group Total	5199	678	48	6	8	5939	1.04
North Central							
Cabinet	417	86	10	0	0	513	1.95
Flathead	1272	145	23	2	2	1444	1.87
Kootenai	1827	339	26	8	5	2205	1.77
Lolo	2500	501	37	5	3	3046	1.48
Group Total	6016	1071	96	15	10	7208	1.68
Western Zone Total	19057	2996	271	38	52	22414	1.61

Table II-14. Number of Lightning Fires By Size Class in the Eastern Zone National Forests, Region One, 1946-1973.

Group and National Forest	Size Class of Fires A	B	C	D	E+ (1)	Total	% Class C or Larger
Northeastern							
Deerlodge	452	138	12	6	1	609	3.12
Helena	781	245	33	3	4	1066	3.75
Lewis & Clark	476	141	32	7	5	661	6.66
Group Total	1709	524	77	16	10	2336	4.41
Southeastern							
Beaverhead	420	92	16	7	2	537	4.66
Custer	476	488	93	19	13	1089	11.48
Gallatin	394	63	15	2	4	478	4.39
Group Total	1290	643	124	28	19	2104	8.13
Eastern Zone Total	2999	1167	201	44	29	4440	6.17

(1) Includes all fires 300 acres or more in size

Average Size Per Fire

Lightning fires in Region One have an average size of more than ten acres. During the 1946-1973 period the average size per lightning fire was 11.86 acres (Table II-15). This is a significant reduction in average size when compared to the 26.05 acres per lightning fire recorded in the 1931-1945 period (Barrows, 1951). These figures are strongly influenced in both periods by a few very large fires.

Lightning fires in the Western Zone average less than 10 acres in size. During the 1946-1973 period fires in this zone averaged 9.01 acres in size (Table II-15). The Northwestern group had an average size per fire of 14.57 acres. The Kaniksu National Forest of this group had the highest average size per fire in Region One. This average of 45.03 acres strongly reflects the impact of the large fires occurring in 1967. Fires on the Bitterroot and Nezperce forests averaged more than 10 acres in size. Fires on all other forests in the Western Zone averaged less than five acres in size.

Lightning fires in the Eastern Zone average more than 25 acres in size. In the 1946-1973 period the average size per fire was 26.23 acres or nearly three times greater than the Western Zone average (Table II-15). Little difference in average fire size was noted between the Northeastern and Southeastern groups. Fires on the Helena National Forest had an average size of 44.96 acres, largest in the Eastern Zone and second only to the record on the Kaniksu. Fires on the Custer had an average size of 37.82 acres, a record also greater than that of any Western Zone forest except the Kaniksu. The Eastern Zone fire size average reflects the influence of grass fuel prevailing in this zone.

Table II-15. Average Size Per Lightning Fire in Region One National Forests, 1946-1973.

Western Zone	Acres Per Fire
Southwestern	
Bitterroot	16.13
Clearwater	4.22
Nezperce	10.61
Group Average	10.48
Northwestern	
Coeur d'Alene	0.45
Colville	1.08
Kaniksu	45.03
St. Joe	0.93
Group Average	14.57
North Central	
Cabinet (1)	0.56
Flathead	2.06
Kootenai	3.85
Lolo	2.17
Group Average	2.55
Western Zone Average	9.01

Eastern Zone	Acres Per Fire
Northeastern	
Deerlodge	8.32
Helena	44.96
Lewis and Clark	17.91
Group Average	27.75
Southeastern	
Beaverhead	6.55
Custer	37.82
Gallatin	14.51
Group Average	24.54
Eastern Zone Average	26.23
Region One Average	11.86

(1) Cabinet includes only 1946-1953 period.

Area Burned

Lightning fires burned more than three-quarters of a million acres in 43 years. As shown in Table II-16, lightning fires burned 761,686 acres in Region One national forests during the years 1931-1973. This is an annual average burn of 17,714 acres during the 43-year period. The area burned exceeded 32,000 acres during seven of these years. The peak burn in a single year was 300,168 acres in 1934.

Lightning fires burn more acres than man-caused fires. During the 1931-1973 period lightning fires accounted for 61 percent of the area burned in Region One. The distribution of area burned by lightning and man-caused fires was as follows:

	Acres Burned		
Period	Lightning Fires	Man-Caused Fires	Total All Fires
1931-1945	443,186	371,579	814,765
1946-1973	318,500	117,923	435,423
1931-1973	761,686	488,212	1,249,898

The percent of area burned by lightning fires has increased. During the 1946-1973 period lightning fires accounted for 73 percent of the area burned in Region One national forests (Table II-17). This is a substantial increase from the 54 percent burned by lightning fires in the 1931-1945 period (Barrows, 1951). This increase probably reflects the effectiveness of the overall fire prevention and control program for man-caused fires. It also emphasizes the continuing importance of lightning fires.

The average annual area burned by both lightning and man-caused fires has increased in recent years. As shown in Table II-17 the average annual area burned by both fire causes has increased since 1959. The area burned by man-caused fires nearly doubled in both the 1960-1966 and 1967-1973

Table II-16. Area Burned by Lightning Fires in Region One National Forests During 1931-1945 and 1946-1973 Periods.

1931 - 1945 Period		1946-1973 Period	
Year	Acres Burned	Year	Acres Burned (1)
1931	34819	1946	5451
		1947	14683
1932	6637	1948	46
		1949	56291
1933	9005	1950	377
		1951	1126
1934	300168	1952	323
		1953	7646
1935	6637	1954	568
		1955	2206
1936	17343	1956	1894
		1957	488
1937	1601	1958	2130
		1959	812
1938	1167	1960	17120
		1961	52141
1939	14008	1962	2374
		1963	1677
1940	35542	1964	1384
		1965	84
1941	579	1966	32369
		1967	87556
1942	1499	1968	3967
		1969	998
1943	2284	1970	10027
		1971	416
1944	4045	1972	1026
		1973	13320
1945	8852		
Total	443186		318500
Annual Average	29546		11375
Annual Average Per Million Acres Protected	881.70		457.43

(1) Acres burned may be slightly greater than indicated because of incomplete data on class A fires and some larger fires involving other than Forest Service Ownership.

Table II-17. Area Burned by Lightning and Man-Caused Fires In Region One During Seven Year Periods 1946-1973.

Years	Item	Lightning Fires	Man-Caused Fires	Total Fires
1946-1952	Acres Burned	78,297	15,224	93,521
	Annual Ave.	11,185	2,175	13,360
	Percent	83.7	16.3	
1953-1959	Acres Burned	15,744	16,443	32,187
	Annual Ave.	2,249	2,349	4,598
	Percent	48.9	51.1	
1960-1966	Acres Burned	107,149	28,372	135,521
	Annual Ave.	15,307	4,053	19,360
	Percent	79.0	21.0	
1967-1973	Acres Burned	117,310	57,884	175,194
	Annual Ave.	16,759	8,269	
	Percent	67.0	33.0	
Total 1946-1973	Acres Burned	318,500	117,923	436,423
	Annual Ave.	11,375	4,212	15,587
	Percent	73.0	27.0	

periods. However, in these two periods man-caused fires accounted for only 21 and 33 percent, respectively, of the total area burned.

Great variability exists in the area burned by lightning fires in a single year. In three years (1949, 1961, 1967) during the 1946-1973 period more than 50,000 acres were burned. In two years (1948, 1965) less than 100 acres were burned (Table II-16). The burning of 87,556 acres by lightning fires in 1967 is the second highest total over a 43-year period. The burning of 56,291 acres in 1949 and 52,141 acres in 1961 also rank very high in recent Region One fire history. The important environmental and fire control factors involved in these severe fire seasons are analyzed in later sections of this report.

The largest area burned is in the Western Zone national forests. During the 1946-1973 period 63.43 percent of the area burned by lightning fires in Region One was in the Western Zone (Table II-18). The total burn for the zone was 202,030 acres or an annual average of 7215 acres. Within the zone 48 percent of the area burned was in the Southwestern group of national forests and 43 percent in the Northwestern group. A remarkably small area of only 18,376 acres was burned in the North Central group. This amounted to nine percent of the zone total and the smallest area burned by any group of national forests in Region One.

The Eastern Zone accounts for more than one-third of the area burned. In the 1946-1973 period lightning fires burned 116,471 acres in the zone or 36.57 percent of the regional total (Table II-18). The area burned in the Northeastern group amounted to 56 percent of the zone total and the Southeastern group, 44 percent. The percent burned in these two groups of national forests is exceeded only by the Southwestern and Northwestern groups in the Western Zone.

Table II-18. Area Burned by Lightning Fires In Western and Eastern Zones of Region One, 1946-1973.

	Western Zone			
	Southwestern Group	Northwestern Group	North Central Group	Total
Acres Burned	97,148	86,506	18,376	202,030
Annual Average	3,470	3,090	656	7,215
Percent of Zone Burn	48.09	42.82	9.09	
Percent of Region One Burn	30.50	27.16	5.77	63.43

	Eastern Zone		
	Northeastern Group	Southeastern Group	
Acres Burned	64,834	51,637	116,471
Annual Average	2,315	1,844	4,160
Percent of Zone Burn	55.66	44.33	
Percent of Region One Burn	20.36	16.21	36.57

	Region One
Acres Burned	318,501
Annual Average	11,375

Lightning fires in the Kaniksu, Bitterroot and Nezperce national forests account for more than four-fifths of the area burned in the Western Zone. During the 1946-1973 period fires in these forests burned 169,325 acres (Tables II-19 and II-20). This amounts to 83 percent of the zone total and 53 percent of the area burned in Region One. The burning of 83,084 acres in the Kaniksu was the highest of any forest. The Kaniksu also had the largest area burned per million acres protected.

The largest area burned in individual Western Zone forests occurred in seven years. The area burned by lightning fires in five forests during the fire seasons of 1947, 1953, 1960, 1961, 1967, 1968 and 1973 accounted for 80 percent of the area burned in the zone during the 1946-1973 period. In each of these years one or more Western Zone forests had more than 3000 acres burned (Tables II-19, II-20 and II-21). The area burned on individual national forests during these years was as follows:

Year	Forest	Acres Burned
1947	Bitterroot	5410
1953	Nezperce	3042
1960	Bitterroot	3494
	Lolo	3194
	Nezperce	7788
1961	Bitterroot	29372
	Clearwater	8337
	Nezperce	7756
1967	Kaniksu	74514
	Nezperce	8712
1968	Nezperce	3684
1973	Nezperce	5809

Lightning fires in the Custer and Helena national forests account for nearly four-fifths of the area burned in the Eastern Zone. During the 1946-1973 period the area burned on these two forests was 92,112 acres

Table II-19 Area Burned by Lightning Fires in the Southwestern Group of Western Zone National Forests, 1946-1973.[1/]

Year	National Forest			Group
	Bitterroot	Clearwater	Nezperce	Total
1946	104	15	2554	2673
1947	5410	63	139	5612
1948	0	4	3	7
1949	74	38	308	420
1950	4	2	23	29
1951	36	19	38	93
1952	11	2	37	50
1953	418	189	3042	3649
1954	48	1	16	65
1955	77	0	28	105
1956	227	0	44	271
1957	70	0	29	99
1958	6	15	145	166
1959	3	13	60	76
1960	3494	91	7788	11373
1961	29372	8337	7756	45465
1962	1906	18	62	1986
1963	93	8	606	707
1964	2	13	25	40
1965	16	2	25	43
1966	221	17	288	526
1967	84	1910	8712	10706
1968	79	14	3684	3777
1969	8	9	32	49
1970	0	35	50	85
1971	0	35	11	46
1972	25	6	66	97
1973	3073	51	5809	8933
Total	44861	10907	41380	97148
Average Annual Area Burned	1602	390	1478	3470
Average Annual Area Burned Per Million Acres	991.70	297.57	686.62	658.63

[1/] Zero acres means that none of the individual fires burned more than one acre.

Table II-20. Area Burned by Lightning Fires in the Northwestern Group of Western Zone National Forests, 1946-1973.

Year	National Forest				Group Total
	Colville	Coeur d'Alene	Kaniksu	St. Joe	
1946	0	46	369	506	921
1947	71	63	7326	7	7467
1948	0	0	3	0	3
1949	46	24	42	11	123
1950	0	0	126	0	126
1951	3	3	60	817	896
1952	5	9	69	55	138
1953	0	5	14	5	24
1954	0	1	10	2	13
1955	0	0	21	0	21
1956	8	0	206	0	214
1957	7	0	2	18	27
1958	8	32	36	1	77
1959	2	0	0	147	149
1960	11	0	4	17	32
1961	18	277	53	47	395
1962	28	3	10	5	46
1963	92	13	42	15	162
1964	4	0	0	2	6
1965	0	1	6	1	8
1966	1	1	33	5	40
1967	579	13	74514	31	75137
1968	0	1	1	4	6
1969	0	3	51	102	156
1970	33	0	0	25	58
1971	0	10	46	0	56
1972	4	1	0	4	9
1973	163	1	40	5	209
Total	1083	507	83084	1832	86506
Average Annual Area Burned	39	18	2967	65	7215
Average Annual Area Burned Per Million Acres	42.86	19.66	1858.96	77.04	499.63

Table II-21. Area Burned by Lightning Fires in the Northcentral Group of Western Zone National Forests, 1946-1973.

Year	National Forest				Group Total
	Cabinet	Flathead	Kootenai	Lolo	
1946	58	110	904	207	1279
1947	59	56	138	91	344
1948	1	0	0	9	10
1949	36	15	47	96	194
1950	7	0	0	107	114
1951	51	10	2	30	93
1952	8	0	5	24	37
1953	69	188	213	701	1171
1954		0	0	3	3
1955		0	1	287	288
1956		0	4	44	48
1957		3	29	17	49
1958		1085	777	9	1871
1959		72	2	19	93
1960		29	291	3194	3514
1961		25	110	372	507
1962		5	198	25	228
1963		2	38	113	153
1964		0	153	5	158
1965		0	1	3	4
1966		155	4	25	184
1967		201	1207	85	1493
1968		0	51	73	124
1969		302	6	21	329
1970		47	2297	162	2506
1971		0	0	10	10
1972		7	0	739	746
1973		664	2012	150	2826
Total	289	2976	8490	6621	18376
Average Annual Area Burned	36	106	303	237	656
Average Annual Area Burned Per Million Acres	28.64	45.48	166.98	106.57	86.92

(Tables II-22 and II-23). This was 79 percent of the Eastern Zone total and 29 percent of the area burned in Region One. The burning of 47,926 acres in the Helena was the second highest total in Region One. The Helena average annual area burned per million acres protected also was the second highest in the region.

The largest area burned in individual Eastern Zone forests occurred in four years. The area burned by lightning fires in five forests during the fire seasons of 1949, 1961, 1966 and 1970 accounted for 83 percent of the zone total. In each of these years one or more Eastern Zone forests had more than 3000 acres burned (Tables II-22 and II-23). It is interesting to note that the peak years for area burned do not correspond with those of the Western Zone except for 1961. The area burned on individual Eastern Zone forests during peak years was as follows:

Year	Forest	Acres Burned
1949	Custer	4857
	Deerlodge	3678
	Helena	42187
	Gallatin	4484
1961	Helena	4197
1966	Custer	29701
1970	Lewis and Clark	7064

Wide variation exists between Region One national forests in the area burned per million acres protected. This is an important factor in evaluation of fire impacts. During the 1946-1973 period the average annual area burned by lightning fires per million acres protected on individual national forests varied from a low of 20 acres to a high of 1859 acres (Tables II-19 through II-23). In evaluating this factor the Region One national forests may be divided into three classifications as follows:

Average Annual Area Burned by Lightning Fires per Million Acres Protected.

More than 1000 acres

Kaniksu	1859 acres
Helena	1775 acres
Custer	1245 acres

500 to 1000 acres

Bitterroot	992 acres
Nezperce	687 acres

Less than 500 acres

Clearwater	298 acres
Lewis and Clark	230 acres
Kootenai	167 acres
Deerlodge	160 acres
Gallatin	145 acres
Lolo	107 acres
St. Joe	77 acres
Beaverhead	60 acres
Flathead	45 acres
Colville	43 acres
Coeur d'Alene	20 acres

Table II-22. Area Burned by Lightning Fires in the Northeastern Group of Eastern Zone National Forests, 1946-1947

Year	National Forest			Group Total
	Deerlodge	Helena	Lewis & Clark	
1946	10	165	2	177
1947	194	7	25	226
1948	5	3	4	12
1949	3678	42187	263	46128
1950	0	3	0	3
1951	3	1	5	9
1952	2	0	0	2
1953	551	260	587	1398
1954	6	42	5	53
1955	0	0	1411	1411
1956	1	46	234	281
1957	6	50	13	69
1958	0	2	8	10
1959	2	0	57	59
1960	69	470	542	1081
1961	382	4197	128	4707
1962	4	4	0	8
1963	0	25	78	103
1964	20	18	10	48
1965	0	5	0	5
1966	5	51	1092	1148
1967	61	42	4	107
1968	11	7	0	18
1969	12	92	138	242
1970	0	11	7064	7075
1971	0	151	103	254
1972	39	21	0	60
1973	8	66	66	140
Total	5069	47926	11839	64834
Average Annual Area Burned	181	1712	423	762
Average Annual Area Burned Per Million Acres	159.51	1775.13	229.56	721.40

Table II-23. Area Burned by Lightning Fires in the Southeastern Group of Eastern Zone National Forests, 1946-1973.

Year	National Forest			Group Total
	Beaverhead	Custer	Gallatin	
1946	3	292	106	401
1947	449	496	89	1034
1948	3	9	2	14
1949	85	4857	4484	9426
1950	0	5	100	105
1951	0	48	0	48
1952	11	85	0	96
1953	307	86	1011	1404
1954	0	425	9	434
1955	365	8	8	381
1956	18	937	125	1080
1957	231	13	0	244
1958	2	4	0	6
1959	0	369	66	435
1960	424	677	19	1120
1961	189	771	107	1067
1962	85	21	0	106
1963	25	521	6	552
1964	1071	57	4	1132
1965	7	17	0	24
1966	32	29701	738	30471
1967	4	92	17	113
1968	0	33	9	42
1969	1	195	26	222
1970	42	261	0	303
1971	0	50	0	50
1972	0	114	0	114
1973	163	1041	8	1212
Total	3517	41186	6934	51637
Average Annual Area Burned	126	1471	248	615
Average Annual Area Burned Per Million Acres	58.99	1244.57	144.69	641.20

III. Lightning Fire Environment

In this chapter data and discussion are presented to describe the influences of several physical environmental features on the ignition and size of lightning fires. Eight environmental indicators are used and are divided into four basic groups as follows: 1) topography, a) elevation, b) slope, c) aspect, d) topography type; 2) forest type, a) cover type; 3) fuels, a) rate-of-spread adjective class, b) resistance to control; 4) weather and fire danger, a) burning index adjective class. Each of these variables are divided into discrete ranges, types or adjective classes. For each of these categories the number of fires in the category, the percent of those fires that reach class C or larger (C+), the percentage of all fires in the forest group that occurred in that category and the percentages of all C+ fires that occurred in the category were tabulated.

During the period of record, virtually all fires burned under a policy of fire control so, in a sense, suppression was part of the lightning fire environment. For most fire management purposes this factor does not destroy the usefulness of these data. Still, the possible effects of suppression should be kept in mind when interpreting the effects of more natural environmental factors.

III-1 Topography

Data for four topographic parameters are presented in Tables III-1 through III-4. These are elevation, (steepness of) slope, aspect and topography type. The useful period of record is 1950-1969 for elevation, 1950-1973 for slope and aspect and 1960-1969 for topography type.

Fires in each forest group are concentrated in a 2000 ft. elevation zone. With exceptions on the small scale, fire ignition and behavior change with elevation because of changes of climate and forest type and, perhaps, lightning strikes. Fires were separated into one thousand foot elevation ranges and their distribution is shown in Table III-1. With the exception of the SE group a definite band of high occurrence can be found with a 2000 foot range including over 50% of the fires. Comparing the highest lightning fire frequency elevation ranges against elevation data presented for a similar area by Barrows (1951) indicates that the maximum fire elevation range tends to be about 1000 feet higher than the elevation range with the most surface area. The SE group shows no clear trend of fire occurrence.

The likelihood of a fire becoming large (C+) increases slightly with elevation. Exceptions are the SE group and at the lower elevation, of the SW group. This trend may result from a combination of changes in cover type, surface fuel loading and decreased access to suppression forces.

The likelihood of large fires increases on steeper slopes. Physical models of fire spread and work by Barrows (1951) show that the rate of spread is proportional to the steepness of slope. Lightning fire ignition is not related to slope except where ignitable fuels become more

FIRES BY FOREST GROUP AND ELEVATION

(1950-1969)

Forest Group	Elev. (ft.)	Number of Fires	Number of C + Fires	% of All Fires C+	% of all Fires	% of C+ Fires
Southeast	1000-1999	-	-			
	2000-2999	30	9	-	2.0	8.6
	3000-3999	427	36	8.4	28.3	34.3
	4000-4999	249	23	9.2	16.5	21.9
	5000-5999 *	42	2	4.8	2.8	1.9
	6000-6999	257	13	5.1	17.0	12.4
	7000-7999	274	10	3.6	18.1	9.5
	8000-8999	154	8	5.2	10.2	7.6
	9000-+	77	4	5.2	5.1	3.8
	Total	1510	105	7.2		
Northeast	1000-1999	-	-	-		
	2000-2999	2	0	-	0.1	0
	3000-3999	13	2	2.7	0.8	3.4
	4000-4999	221	6	3.4	13.7	10.3
	5000-5999	503	17	3.4	31.1	29.3
	6000-6999	507	21	4.1	31.3	36.2
	7000-7999	281	7	2.5	17.4	12.1
	8000-8999	85	4	4.7	5.3	6.9
	9000+	6	1	-	0.4	1.7
	Total	1618	58	3.6		
Southwest	1000-1999	18	5	-	0.3	3.6
	2000-2999	134	7	5.2	2.2	5.0
	3000-3999	530	26	4.9	8.7	18.6
	4000-4999	1312	20	1.5	21.4	14.3
	5000-5999	1870	25	1.3	30.5	17.9
	6000-6999	1283	30	2.3	20.9	21.4
	7000-7999	713	24	3.4	11.6	17.1
	8000-8999	259	3	1.2	4.2	2.1
	9000+	8	0	-	0.1	0.0
	Total	6127	140	2.3		
North	1000-1999	4	0	-	0.1	0.0
	2000-2999	186	3	1.6	4.0	3.6
	3000-3999	875	13	1.7	18.9	15.5
	4000-4999	1242	16	1.2	26.8	19.0
	5000-5999	1188	23	1.9	25.6	27.4
	6000-6999	755	22	2.9	16.3	26.2
	7000-7999	300	7	2.3	6.5	8.3
	8000-8999	33	0	0.0	0.7	0.0
	9000+	-	-	-	0.0	0.0
	Total	4633	84	1.8		
Northwest	1000-1999	12	0	-	0.3	0.0
	2000-2999	328	3	0.9	8.1	7.1
	3000-3999	1136	8	0.7	28.2	19.0
	4000-4999	1235	18	1.5	30.7	42.9
	5000-5999	968	7	0.7	24.0	16.7
	6000-6999	331	6	1.8	8.2	14.3
	7000-7999	18	0	-	0.4	0.0
	8000-8999	1	0	-	0.1	0.0
	9000+	-	-	-		
	Total	4029	42	1.0		

*Note Small Sample

sparse with steeper slopes. Indeed, the data in Table III-2 show that ignition is relatively evenly distributed between the slope classes until very steep slopes are encountered. Decreases of ignition with slope occur at about 50% slope in the SE group, 70% in the NE group and 80-100% in the three western groups. With the exceptions of the SE group and the flatter slopes in the NE and possibly the SW groups there is an increasing likelihood that a fire will reach C+ with increasing slope steepness. The percent of fires C+ changes by a factor of 2 to 5 depending on the forest group (still with the exception of the SE group). While this trend is persistent in the four forest groups it results from small differences in small numbers and the increase of percent C+ with slope is not smooth. A clearer illustration of this trend can be found in the distribution of C+ fires with slope (since the distribution of all fires for most slopes is fairly even). Clearly, for four of the forest groups there are more C+ fires on steep slopes than on flat ones. The data for the SE forest group shows a reverse trend. This might be in part due to the large number of fires and C+ fires occurring in the Deciduous-Brush-Grass Cover type (Table III-5) and relatively larger areas of flat slopes in this group compared to the other forest groups.

There is no strong relationship between aspect and the potential for ignition or for large fires. The direction that a slope faces determines the potential insolation on the slope and therefore strongly influences the forest type, humidity, temperature and fuel moisture of the slope. Barrows (1951) found that the greatest number of fires (both lightning and man caused) were ignited on the south and then southwest facing slopes for the period 1931-1944. He also found that the largest percent of those

Table III-2. Fires by Forest Group and Slope (1950-1973)

Forest Group	Slope(%)	Number of Fires	Number of C+ Fires	% of Fires C+	% of All Fires	% of C+ Fires
Southeast	0-9	317	29	9.1	17.1	20.9
	10-19	291	22	7.6	15.7	15.8
	20-29	286	17	5.9	15.4	12.2
	30-39	271	19	7.0	14.6	13.7
	40-49	186	18	9.7	10.0	12.9
	50-59	172	10	5.8	9.3	7.2
	60-69	141	8	5.7	7.6	5.8
	70-79	66	5	7.6	3.6	3.6
	80-100	120	10	8.3	6.5	7.2
	100+	4	1	-	0.2	0.7
	Total	1854	139	7.5		
Northeast	0-9	212	12	5.7	10.6	14.5
	10-19	258	8	3.1	12.9	9.6
	20-29	310	6	1.9	15.5	7.2
	30-39	325	9	2.8	16.3	10.8
	40-49	202	11	5.4	10.1	13.3
	50-59	207	9	4.3	10.4	10.8
	60-69	204	12	5.9	10.2	14.5
	70-79	128	8	6.3	6.4	9.6
	80-100	140	8	5.7	7.0	9.6
	100+	11	0	-	0.0	0.0
	Total	1997	83	4.2		
Southwest	0-9	465	3	0.6	5.8	1.8
	10-19	764	3	0.4	9.5	1.8
	20-29	1062	1	0.1	13.2	0.6
	30-39	1232	16	1.3	15.4	9.7
	40-49	859	22	2.6	10.7	13.3
	50-59	899	11	1.2	11.2	6.7
	60-69	1068	37	3.5	13.3	22.4
	70-79	718	22	3.1	8.9	13.3
	80-100	928	49	5.3	11.6	29.7
	100+	48	1	2.1	0.6	0.6
	Total	8023	165	2.1		
North	0-9	736	4	0.5	12.9	3.9
	10-19	609	5	0.8	10.3	4.9
	20-29	730	11	1.5	12.3	10.7
	30-39	851	11	1.3	14.4	10.7
	40-49	599	11	1.8	10.1	10.7
	50-59	648	17	2.6	10.9	16.5
	60-69	755	18	2.4	12.7	17.5
	70-79	449	14	3.1	8.4	13.6
	80-100	530	12	2.3	9.9	11.7
	100+	16	0	-	0.0	0.0
	Total	5923	103	1.7		
Northwest	0-9	360	2	0.6	7.3	3.7
	10-19	454	4	0.9	9.3	7.4
	20-29	657	4	0.6	13.4	7.4
	30-39	1010	6	0.6	20.6	11.1
	40-49	540	9	1.7	11.0	15.7
	50-59	583	5	0.9	11.9	9.3
	60-69	578	7	1.2	11.9	13.0
	70-79	502	9	1.8	10.2	16.7
	80-100	211	8	3.8	4.3	14.8
	100+	13	0	-	0.0	0.0
	Total	4908	54	1.1		

fires reaching C+ occurred on southwest then south slopes. The data for the 1950-1973 period presented in Table III-3 do not show as clear a pattern. (There is a tendency to code aspects as north, east, south or west rather than southeast, southwest, etc).

The number of lightning fire ignitions is largest on south facing slopes in four of the forest groups. In the fifth group (NO) south slopes seem a close second to northeast slopes. Of the forest groups that had the largest number of fires on south slopes three had the second most number of fires on northeast facing slopes and one had second most on north slopes. Although maxima of fire ignitions on south and then northeast slopes are persistent they have only slightly higher lightning fire occurrence than other aspects.

The percent of fires C+ for each aspect also shows a southeast maximum in four of the forest groups. The highest percent C+ occurs on southeast facing slopes except in the NO group where southeast is second to west facing slopes. As with the fire occurrences, the maxima are not large and no clear general pattern is established.

Ignition potential is highest on upper slope positions while large fire potential is greatest on the lower 1/3 of slopes. During the 1960's a descriptive topography type was included in individual fire reports. The distribution of fires by topography type is given in Table III-4. Over three-fourths of lightning fire ignitions occurred in the three topography categories of ridgetop, upper 1/3 of slope and middle 1/3 of slope. Most C+ fires are on the upper two-thirds of the slope (not ridgetop). However, the chances of a fire becoming C+ once started, is generally higher on the lower two-thirds of a slope (for those categories with large samples).

T A B L E III-3

FIRES BY FOREST GROUP AND ASPECT

FOREST GROUP	ASPECT	NUMBER OF FIRES	NUMBER OF C+ FIRES	% OF ALL FIRES C+	% OF ALL FIRES	% OF C+ FIRES
SOUTHEAST	NORTH	244	22	9.0	12.6	15.8
	NORTHEAST	231	11	4.8	11.9	7.9
	EAST	195	14	7.2	10.1	10.1
	SOUTHEAST	167	17	10.1	8.6	12.2
	SOUTH	261	18	6.9	13.5	12.9
	SOUTHWEST	178	12	6.7	9.2	8.6
	WEST	200	12	6.0	10.3	8.6
	NORTHWEST	107	10	9.3	5.5	7.2
	RIDGE	84	7	8.3	4.3	5.0
	FLAT	271	16	5.9	14.0	11.5
	TOTAL	1938	139			
NORTHEAST	NORTH	277	13	4.7	13.9	16.0
	NORTHEAST	292	11	3.8	14.6	13.6
	EAST	206	15	7.3	10.3	18.5
	SOUTHEAST	186	9	4.8	9.3	11.1
	SOUTH	330	11	3.3	16.5	13.6
	SOUTHWEST	187	7	3.7	9.4	8.6
	WEST	245	11	4.5	12.3	13.6
	NORTHWEST	92	1	1.1	4.6	1.2
	RIDGE	55	2	3.6	2.8	2.5
	FLAT	127	1	0.8	6.4	1.2
	TOTAL	1997	81	4.1		
SOUTHWEST	NORTH	1065	18	1.7	13.3	11.5
	NORTHEAST	1255	29	2.3	15.7	18.5
	EAST	763	10	1.3	9.5	6.4
	SOUTHEAST	798	25	3.1	10.0	15.9
	SOUTH	1307	27	2.1	16.3	17.2
	SOUTHWEST	936	5	0.5	11.7	3.2
	WEST	881	25	2.8	11.0	15.9
	NORTHWEST	413	5	1.2	5.2	3.2
	RIDGE	84	0	0.0	1.1	0.0
	FLAT	493	13	2.6	6.2	8.3
	TOTAL	7995	157	2.0		
NORTH	NORTH	645	8	1.2	10.7	7.6
	NORTHEAST	890	20	2.2	14.8	19.0
	EAST	596	15	2.7	9.9	14.3
	SOUTHEAST	590	16	2.7	9.8	15.2
	SOUTH	879	9	1.0	14.6	8.6
	SOUTHWEST	648	6	0.4	10.8	5.7
	WEST	734	25	3.4	12.2	23.8
	NORTHWEST	309	4	1.3	5.1	3.8
	RIDGE	222	0	0.0	3.7	0
	FLAT	499	2	0.4	8.3	1.9
	TOTAL	6012	105	1.7		
NORTHWEST	NORTH	624	2	0.3	12.9	4.2
	NORTHEAST	668	10	1.5	13.8	20.8
	EAST	640	5	0.8	13.2	10.4
	SOUTHEAST	467	10	2.1	9.7	20.8
	SOUTH	715	6	0.8	14.8	12.5
	SOUTHWEST	524	5	1.0	10.8	10.4
	WEST	539	3	0.6	11.2	6.3
	NORTHWEST	204	4	2.0	4.2	8.3
	RIDGE	86	0	0.0	1.8	0.0
	FLAT	347	3	0.9	7.2	6.3
	TOTAL	4834	48	1.0		

T A B L E III- 4

FIRES BY FOREST GROUP AND TOPOGRAPHY TYPE
(1960-1969)

FOREST GROUP	TOPOG TYPE	NUMBER OF FIRES	NUMBER OF C+ FIRES	% OF FIRES C+	% OF ALL FIRES	% OF C+ FIRES
SOUTHEAST	RIDGETOP	235	17	7.2	27.1	22.4
	SADDLE	8	0	--	0.9	0.0
	UPPER 1/3	254	20	7.9	29.3	26.3
	MIDDLE 1/3	179	16	8.9	20.6	21.1
	LOWER 1/3	117	11	9.4	13.5	14.5
	CANYON BOTTOM	10	1	--	1.2	1.3
	VALLEY BOTTOM	18	1	--	2.1	1.3
	PLATEAU	30	4	13.3	3.5	5.3
	OTHER	17	6	--	2.0	7.9
	TOTAL	868	76	8.8		
NORTHEAST	RIDGETOP	255	1	0.4	2.63	3.0
	SADDLE	5	0	--	0.5	0.0
	UPPER 1/3	299	10	3.3	20.9	30.3
	MIDDLE 1/3	273	16	5.9	28.2	48.5
	LOWER 1/3	85	3	3.5	8.8	9.1
	CANYON BOTTOM	5	2	--	0.5	6.1
	VALLEY BOTTOM	21	1	--	2.2	3.0
	PLATEAU	18	0	--	1.9	0.0
	OTHER	1	0	--	0.1	0.0
	TOTAL	969	33	3.4		
SOUTHWEST	RIDGETOP	976	11	1.1	27.3	11.2
	SADDLE	13	1	--	0.4	1.0
	UPPER 1/3	1114	26	2.3	30.5	26.5
	MIDDLE 1/3	1089	34	3.1	24.8	34.7
	LOWER 1/3	339	22	6.5	9.3	22.4
	CANYON BOTTOM	34	1	2.9	0.9	1.0
	VALLEY BOTTOM	41	3	7.3	1.1	3.1
	PLATEAU	23	0	--	0.6	0.0
	OTHER	1	0	--	0.0	0.0
	TOTAL	3650	98	2.7		
NORTH	RIDGETOP	542	1	0.2	21.4	2.4
	SADDLE	18	0	--	0.7	0.0
	UPPER 1/3	708	16	2.3	28.0	39.0
	MIDDLE 1/3	679	14	2.1	26.9	34.1
	LOWER 1/3	339	8	2.4	13.4	19.5
	CANYON BOTTOM	15	0	--	0.6	0.0
	VALLEY BOTTOM	171	1	0.6	6.8	2.4
	PLATEAU	51	0	0.0	2.0	0.0
	OTHER	5	1	--	0.2	2.4
	TOTAL	2528	41	1.6		
NORTHWEST	RIDGETOP	367	3	0.8	15.9	13.6
	SADDLE	11	0	--	0.5	0.0
	UPPER 1/3	714	9	1.3	30.7	40.9
	MIDDLE 1/3	816	5	0.6	35.1	22.7
	LOWER 1/3	311	4	1.3	13.4	18.2
	CANYON BOTTOM	12	0	--	0.5	0.0
	VALLEY BOTTOM	67	0	0.0	2.9	0.0
	PLATEAU	16	0	--	0.7	0.0
	OTHER	8	1	--	0.3	4.5
	TOTAL	2322	22	0.9		

III-2. Forest Types

For this analysis ten different forest or cover types were synthesized from the three systems in use during the period of record. Knowledge of the forest type, represented here by the dominant cover type is important to fire management because it exerts strong control on the amount, size, arrangement and microclimate of the fuels and understory vegetation. These differences are evident in the data presented in Table III-5.

More fires are ignited in ponderosa pine than in any other cover type with Douglas-fir forests a distant second. Considering individual forest groups provides a somewhat different picture. Ponderosa pine has a plurality of fires in three forest groups - Southeast, Southwest and North Central - but is second to the Douglas-fir forests in the Northeast group and second to grand fir in the Northwest forest group. The importance of other cover types vary widely between forest groups.

The probability of a fire reaching Class C or larger is greatest in the deciduous-brush-grass category in the two eastern forest groups. In eastern coniferous forests the probability is greatest in ponderosa pine in the Southeast forest group and Engelmann spruce in the Northeast group. It is interesting to note that in the Southeast forest group over 75% of the C+ fires occur in ponderosa pine (45.6%) and the deciduous-brush-grass category (30.6%). In the Southwest forest group the likelihood of a fire growing to C+ is greatest in ponderosa pine (4.4%) and then Engelmann spruce (3.3%). Fires in other cover types reach C+ at a rate of 2.4% or less. Most of the C+ fires can be found in ponderosa pine, subalpine (predominantly subalpine fir) and lodgepole pine cover types.

T A B L E III-5

FIRES BY FOREST GROUP AND COVER TYPE
1950-1973

FOREST GROUP	COVER TYPE	NUMBER OF FIRES	NUMBER OF C+ FIRES	% OF ALL FIRES C+	% OF ALL FIRES	% OF C+ FIRES
SOUTHEAST	DOUGLAS FIR	381	15	3.9	21.1	10.2
	FIR-LARCH	4	1	--	0.2	0.7
	GRAND FIR	2	0	--	0.1	0.0
	PONDEROSA PINE	693	67	9.7	38.4	45.6
	SUBALPINE	111	4	3.6	6.1	2.7
	WESTERN WHITE PINE	2	0	---	0.2	0.0
	LODGEPOLE PINE	336	13	3.9	18.6	8.8
	ENGLEMANN SPR.	39	2	5.1	2.2	1.4
	CEDAR-HEMLOCK	1	0	--	0.1	0.0
	DECID. BRUSH-GRASS	238	45	18.9	13.2	30.6
	TOTAL	1807	147	8.1		
NORTHEAST	DOUGLAS FIR	676	33	4.9	33.9	39.8
	FIR-LARCH	7	0	--	0.4	0.0
	GRAND FIR	2	0	--	0.1	0.0
	PONDEROSA PINE	534	10	1.9	26.7	12.0
	SUBALPINE	128	5	3.9	6.4	6.0
	WESTERN WHITE PINE	7	0	--	0.4	0.0
	LODGEPOLE PINE	457	16	3.5	22.9	19.3
	ENGLEMANN SPR.	71	4	5.6	3.6	4.8
	CEDAR-HEMLOCK	3	0	--	0.2	0.0
	DECID. BRUSH-GRASS	2	15	13.4	0.1	18.1
	TOTAL	1997	183	4.2		
SOUTHWEST	DOUGLAS FIR	1046	13	1.2	13.8	8.0
	FIR-LARCH	126	1	0.8	1.7	0.6
	GRAND FIR	1414	5	0.4	18.6	3.1
	PONDEROSA PINE	1444	63	4.4	19.0	38.7
	SUBALPINE	900	33	2.4	11.9	13.5
	WESTERN WHITE PINE	304	6	2.0	4 0	3.7
	LODGEPOLE PINE	841	20	2.4	11.1	12.3
	ENGLEMANN SPR.	366	12	3.3	4.8	7.4
	CEDAR-HEMLOCK	419	5	1.2	5.5	3.1
	DECID. BRUSH-GRASS	723	16	2.2	9.5	9.9
	TOTAL	7583	163	2.1		
NORTH	DOUGLAS FIR	1051	16	1.5	17.7	15.8
	FIR-LARCH	767	7	0.9	12.9	6.9
	GRAND FIR	254	4	1.6	4.3	4.0
	PONDEROSA PINE	1634	24	1.5	27.5	23.8
	SUBALPINE	596	18	3.0	10.0	17.8
	WESTERN WHITE PINE	71	2	2.8	1.2	2.0
	LODGEPOLE PINE	741	11	1.5	12.5	10.9
	ENGLEMANN SPR.	439	13	3.0	7.4	12.9
	CEDAR-HEMLOCK	101	2	2.0	1.7	2.0
	DECID. BRUSH-GRASS	279	4	1.4	4.7	4.0
	TOTAL	5933	101	1.7		
NORTHWEST	DOUGLAS FIR	505	4	0.8	11.2	7.8
	FIR-LARCH	418	5	1.2	9.3	9.8
	GRAND FIR	794	5	0.6	17.6	9.8
	PONDEROSA PINE	567	8	1.4	12.6	15.7
	SUBALPINE	323	8	2.5	7.2	15.7
	WESTERN WHITE PINE	544	10	1.8	12.1	19.6
	LODGEPOLE PINE	180	2	1.1	4.0	3.9
	ENGLEMANN SPR.	195	4	2.1	4.3	7.8
	CEDAR-HEMLOCK	538	1	0.2	12.0	2.0
	DECID. BRUSH-GRASS	435	4	0.9	9.7	7.8
	TOTAL	4499	51	1.0		

In contrast, the most fires of any size were ignited in ponderosa pine, grand fir and Douglas-fir in that order. Like the Southwest group more fires were ignited in the North Central forest group in ponderosa pine than other cover types. Douglas-fir also had a large number of ignitions. The highest percentage of fires C+ occurred in Engelmann spruce and subalpine covers followed closely by western white pine. In the Northwest forest group the largest number of fires were in grand fir with ponderosa pine, western white pine and cedar-hemlock following. The subalpine cover type had the highest percentage of C+ fires. Over 50% of all C+ fires occurred in the western white pine, subalpine and ponderosa pine cover types in the Northwest forest group.

III-3. Fuel Types

Fuels were stratified into five adjective classes for rate-of-spread and four for resistance-to-control. The system used is similar to that developed by Hornby but with the flash rate of spread category added. Fuel classifications are intended to describe the difficulty of fire control for fire suppression purposes and are not intended to relate to the probability of lightning fire ignition.

Within each forest group the likelihood that a fire will reach Class C or larger increases strongly with increasing rate-of-spread class. Between the "low" and "high" fuel classes the probability that a fire will reach C+ increases by a factor of about 2.2 (SW) to 9 (SE) depending on the forest group. In those forest groups with thirty or more fires in the extreme class, the percent of fires C+ increased by factors of from 3 to 7 between the "high" and "extreme" class. Absolute numbers of C+ fires are generally greatest in medium rate-of-spread fuels and second most in the high classification. The exception is in the Northwest forest group where the relative positions of the two classes are reversed.

In contrast to the rate-of-spread classifications, a steady increase of the percent of fires C+ with increasing resistance to control is found in only two forest groups (North Central and Northwest) although an overall increase between the low and high classes is found in four of the areas (all except Southeast). Within forest groups the largest numbers of C+ fires are found in the low class in the two eastern groups and the medium class in the three western groups.

Table III-6. Fires by Forest Group and Fuel Rate of Spread Adjective Class (1950-1973).

Forest Group	Fuel R.O.S.	Number of Fires	Number of C+ Fires	% of (1) Fires C+	% of (2) All Fires	% of (2) C+ Fires
Southeast	Low	634	12	1.9	34.4	9.1
	Medium	875	52	5.9	47.5	39.4
	High	294	50	17.0	15.9	37.9
	Extreme	34	17	50.0	1.8	12.9
	Flash	7	1	--	0.4	0.8
	Total	1844	132	7.2		
Northeast	Low	960	22	2.3	48.3	28.6
	Medium	735	35	4.8	37.0	45.5
	High	290	17	5.9	14.6	22.1
	Extreme	2	2	--	0.1	2.6
	Flash	1	1	--	0.1	1.3
	Total	1988	77	3.9		
Southwest	Low	2203	27	1.2	27.7	16.7
	Medium	3690	63	1.7	46.4	38.9
	High	1880	49	2.6	23.6	30.2
	Extreme	176	19	10.8	2.2	11.7
	Flash	9	4	--	0.1	2.5
	Total	7985	162	2.0		
North	Low	1588	13	0.8	27.6	13.1
	Medium	2929	53	1.8	50.9	53.5
	High	1215	29	2.4	21.1	29.3
	Extreme	20	4	--	0.3	4.0
	Flash	2	0	--	0.0	0.0
	Total	5754	99	1.7		
Northwest	Low	1027	5	0.5	21.7	9.8
	Medium	2650	18	0.7	56.1	35.3
	High	1012	22	2.2	21.4	43.1
	Extreme	38	6	15.8	0.8	11.8
	Flash	0	0	--	0.0	0.0
	Total	4727	51	1.1		

(1) Percent of fires in ROS class in group.

(2) Percent of all fires in group.

Table III-7. Fires by Forest Group and Fuel Resistance to Control Adjective Class (1950-1973).

Forest Group	Fuel R.T.C.	Number of Fires	Number of C+ Fires	% of (1) Fires C+	% of (2) All Fires	% of (2) C+ Fires
Southeast	Low	1080	85	7.9	58.5	64.4
	Medium	662	49	6.0	35.9	30.3
	High	100	6	6.0	5.4	4.5
	Extreme	4	1	00	0.2	0.8
	Total	1846	132	7.2		
Northeast	Low	1189	41	3.4	59.8	53.2
	Medium	716	22	3.1	36.0	28.6
	High	78	11	14.1	3.9	14.3
	Extreme	4	3	--	0.2	3.9
	Total	1988	77	3.9		
Southwest	Low	2245	59	2.6	28.2	35.3
	Medium	4352	73	1.7	54.7	43.7
	High	1329	33	2.5	16.7	19.8
	Extreme	34	2	5.9	0.4	1.2
	Total	7960	167	2.1		
North	Low	2538	25	1.0	44.0	24.8
	Medium	2775	53	1.9	48.2	52.5
	High	426	15	3.5	7.4	14.9
	Extreme	21	8	--	0.4	7.9
	Total	5760	101	1.8		
Northwest	Low	1329	8	0.6	28.1	15.7
	Medium	2536	20	0.8	53.6	39.2
	High	834	20	2.4	17.6	39.2
	Extreme	30	3	10.0	0.0	5.9
	Total	4729	51	1.1		

(1) Percent of fires in ROS class in group.

(2) Percent of all fires in group.

III-4 Fire Danger Rating

Fire weather and danger rating is described here by a Burning Index adjective class. The Burning Index combines weather factors such as relative humidity, fuel moisture, windspeed, and precipitation to indicate the difficulty of the fire suppression job. The B.I. does not include a lightning ignition risk factor. Three different B.I. systems were used during the period of record. In conjunction with W. C. Fischer of the USDA, Northern Forest Fire Laboratory the numerical outputs of these systems were synthesized to a system of five B.I. adjective classes, as shown in Table III-8. The distribution of fires by these indices are given in Table III-9.

The adjective B.I. class is a good indicator of the likelihood of fires to reach class C or larger. In the SE there is an unexpectedly high percentage of C+ in the low class compared to the moderate and high classes and a a relatively small percentage of C+ fires in the small sample of the extreme class. There is also a slight drop of the percent C+ between the very high and extreme B.I. classes in the NW forest group. Aside from these minor exceptions the increases of percent of fires C+ with increasing B.I. is persistent and, except for the SE forest group, surprisingly consistent and linear. Figure III-1 is a plot of the third column of data from Table III-9 -- the percent of fires class C or larger for each B.I. class and each forest group. The slopes and position of the plots for the three western groups are very similar and are only slightly erratic in the extreme B.I. class where the samples are small. The NE forest group plot has a steeper slope than the western zone, indicating a stronger relationship. As noted, the figures for the SE group are somewhat erratic.

Table III-8.

SUGGESTED ADJECTIVE RATINGS FOR INTERPRETING
FIRE DANGER RATINGS FROM MODEL 5, 6, 8
AND NFDRS, SPREAD PHASE METERS

MODEL 8 METER (1955-1963) INFORMATION SOURCE: Hardy, Syverson, and Dieterich, 1955 and USDA Forest Service, 1964.

Actual Operation			Suggested Adjective Classes		
Class of Day	Burning Index (BI)	Severity Index (SI)	Fire Danger Rating	BI	SI
LOW	1 - 20	1 - 3	LOW	1-20	1-3
MODERATE	21 - 35	4 - 5	MODERATE	21-35	4-5
AVERAGE	36 - 50	6 - 7	HIGH	36-50	6-7
HIGH	51 - 70	8 - 9	VERY HIGH	51-70	8-9
EXTREME	71 - 100	10	EXTREME	71-100	10

NATIONAL FIRE DANGER RATING SYSTEM (NFDRS) SPREAD PHASE (1964-1972)
INFORMATION SOURCE: Fischer, 1969

Actual Operation			Suggested Adjective Classes		
Class of Day	Spread Index (SI)	Buildup Index (BUI)	Fire Danger Rating	SI	BUI
LOW	0 - 9	0 - 34	LOW	0 - 9	0-34
MODERATE	10 - 24	35 - 74	MODERATE	10 - 24	35-74
HIGH	25 - 39	75 - 134	HIGH	25 - 39	75-134
VERY HIGH	40 - 64	135 - 234	VERY HIGH	40 - 64	135-234
EXTREME	65 - 100	235 plus	EXTREME	65 - 100	235 plus

MODEL 5 METER (1938-1943) INFORMATION SOURCE: Model 5 Meter

Actual Operation		Suggested Adjective Classes	
Class of Day	Fire Danger Class	Fire Danger Rating	Fire Danger Class
Class 1	1.0 - 1.4	LOW	1.0 - 2.4
Class 2	1.6 - 2.4	MODERATE	2.6 - 3.4
Class 3	2.6 - 3.4	HIGH	3.6 - 4.4
Class 4	3.6 - 4.4	VERY HIGH	4.6 - 5.4
Class 5	4.6 - 5.4	EXTREME	5.6 - 7.4
Class 6	5.6 - 6.4		
Class 7	6.6 - 7.4		

MODEL 6 METER (1944-1954) INFORMATION SOURCE: Barrows, 1951

Actual Operation		Suggested Adjective Classes	
Class of Day	Burning Index (BI)	Fire Danger Rating	Burning Index (BI)
VERY LOW	1 - 10	LOW	1 - 27
LOW	11 - 27	MODERATE	28 - 44
MODERATE	28 - 44	HIGH	45 - 62
AVERAGE	45 - 62	VERY HIGH	63 - 78
HIGH	63 - 78	EXTREME	79 - 100
VERY HIGH	79 - 95		
EXTREME	96 - 100		

Table III-9. Fires by Forest Group and Adjective Burning Index (1946-1973)

Forest Group	B.I.	Number of Fires	Number of C+ Fires	% of (1) Fires C+	% of (1) All Fires	% of (2) C+ Fires
Southeast	Low	291	19	6.5	17.7	15.2
	Mod.	383	20	5.2	23.3	16.0
	High	505	29	5.7	30.8	23.2
	Very High	445	50	11.2	27.1	40.0
	Extreme	77	7	9.1	4.7	5.6
	Total	1641	125	7.6		
Northeast	Low	317	0	0.0	13.3	0.0
	Mod.	855	11	1.3	35.8	12.5
	High	656	34	5.2	27.5	38.6
	Very High	484	35	7.2	20.3	39.8
	Extreme	76	8	10.2	3.2	9.1
	Total	2388	88	3.7		
Southwest	Low	2115	10	0.5	25.2	6.1
	Mod.	2911	32	1.1	34.7	19.6
	High	2270	70	3.1	27.1	42.9
	Very High	884	41	4.6	10.6	25.2
	Extreme	197	10	5.1	2.4	6.1
	Total	8377	163	1.9		
North	Low	1470	5	0.3	22.7	4.5
	Mod.	2271	28	1.2	35.0	25.0
	High	1946	45	2.3	30.0	40.2
	Very High	738	30	4.1	11.3	26.8
	Extreme	56	4	7.1	0.9	3.6
	Total	6481	112	1.7		
Northwest	Low	1730	4	0.2	30.3	6.7
	Mod.	2495	17	0.7	43.7	28.3
	High	1209	27	2.2	21.2	45.0
	Very High	231	10	4.3	4.0	16.7
	Extreme	49	2	4.1	0.9	3.3
	Total	5714	60	1.1		

(1) Percent in BI class in group.

(2) Percent of all fires in group.

Percentage of Fires Larger than 10 Acres, by Forest Group and Burning Index Adjective Class.

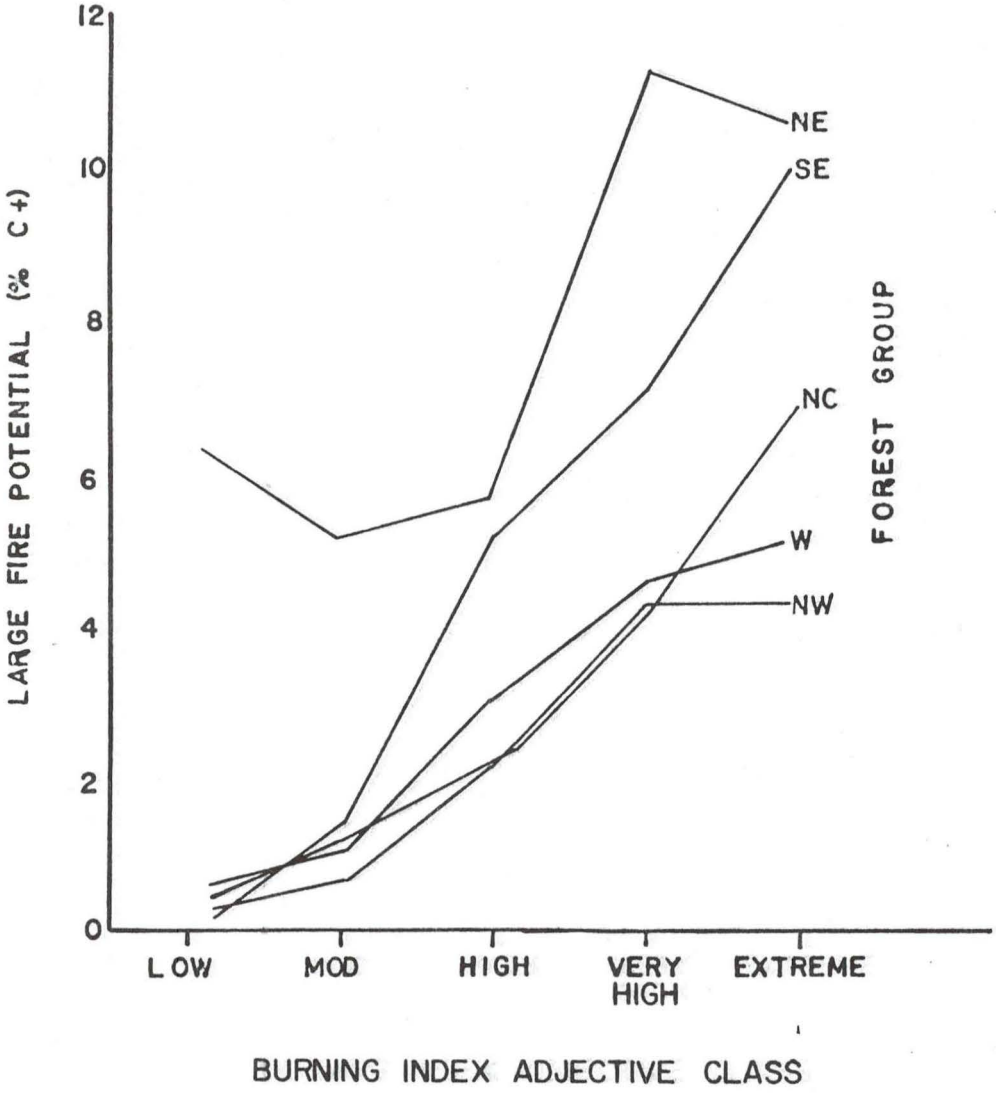

Figure III-1.

Generally the majority of fires are ignited in the moderate and high B.I. categories with exceptions in the SE and NW forest groups. Most C+ fires occur in the high and very high categories except in the NW where moderate and high contain the majority.

Summary

In fire control planning and dispatching, knowledge of ignition tendencies and where effective control will be difficult is crucial. For lightning fires, environmental factors are the key to these problems. From the preceding data, elevation and cover type, with consideration for position on slope, are the best indicators of lightning fire occurrence patterns within individual forest groups. Each group has a distinct high lightning fire ignition elevation range but within the range, ignitions are most likely on the upper two-thirds of a slope or the ridgetop. Also there are cover types in which most fires occur. The best indicators of which fires, once started, are likely to become large (C+) were the forest type, rate-of-spread adjective class, and the burning index in this data set. The percentage of fires reaching Class C or larger increases consistently with increases of burning index and rate-of-spread class. Also, certain forest types in each forest group have greater probabilities of an ignited fire growing to Class C or larger.

In this study certain environmental features indicate fire occurrence and likelihood of large fires better than others. This does not indicate that the other environmental variables should be ignored. Certainly aspect and slope are important in the lightning fire environment, but this environment is a complex composite of interrelated factors. Considering one variable alone may not do justice to its role in the fire environment. Furthermore, Barrows (1951) found much stronger functions of fire ignition and eventual fire size with slope and aspect than was found in this study for a very similar area in earlier years. It is not clear why this difference exists. It is more important that certain

environmental factors have proved good descriptors of lightning fire occurrence and final fire size in both studies.

IV. FIRE CONTROL

Major changes have occurred in the technology and overall systems for the control of lightning fires during the period 1931-1973. During the earlier years the lookout-fireman concept was the backbone of the Region One fire organization. More than 1200 such dual purpose stations were planned to meet detection and initial attack requirements under peak fire load situations. During the 1940 fire season, 847 of these stations were manned (Barrows, 1951). Gradually the lookout-fireman concept was abandoned in favor of approaches providing greater flexibility for both detection and initial attack. These changes also were brought about by the development of smokejumping, aerial detection, aerial attack of fires with chemicals, aerial delivery of equipment, supplies and personnel, road construction, cost considerations and a variety of other factors.

Our studies of lightning fire control during the 1946-1973 period needed to give full recognition to these major changes. An in-depth study of all of these highly significant changes and the accompanying new developments in technology would constitute a major project beyond the scope of the present studies. Moreover, the needed data base for such an in-depth study would require assembly of much information not available on our main data source involving the individual fire reports. For these reasons, the fire control phase of the present research effort has been restricted to selected aspects of detection, initial attack and suppression. All of the Class D or larger lightning fires are examined.

IV-1. Lightning Fire Detection

A major reduction has occurred in the percent of fires detected by lookouts. As shown in Table IV-1 this change is most pronounced in the Western Zone. A summary of the changing role of lookouts in lightning fire detection in each group of national forests is as follows:

Forest Group	Percent of fires detected by lookouts	
	1946-1949	1970-1973
Northwest	62.9	37.0
North Central	69.1	41.4
Southwest	66.9	53.6
Northeast	26.9	23.6
Southeast	16.7	21.9

A large increase has occurred in the percent of lightning fires detected by air observers. Data for aerial detection in all groups of forests are presented in Table VI-1. During the 1970-1973 period, 27 percent of the lightning fires were detected from aircraft in the Western Zone and 20 percent in the Eastern Zone. The change in aerial detection in each group of forests is summarized as follows:

Forest Group	Percent of fires detected by air observers	
	1946-1949	1970-1973
Northwest	7.2	25.7
North Central	---	29.5
Southwest	4.9	26.7
Northeast	6.3	20.0
Southeast	1.6	20.2

Long detection times are common for lightning fires. During the 1946-1973 period the elapsed time from ignition to discovery for all methods of detection was 19.21 hours (Table IV-1). The elapsed detection times for the two major methods of lookouts and air-observers have shown the following changes:

Forest Group	Average Elapsed Detection Time (Hours)			
	Lookouts		Air Observers	
	1946-1949	1970-1973	1946-1949	1970-1973
Northwest	18.37	18.49	22.03	25.08
North Central	19.88	15.15	---	19.80
Southwest	16.44	11.35	27.90	20.68
Northeast	21.53	16.41	27.10	21.72
Southeast	15.90	7.47	17.75	17.91

Table IV-1 Percent of lightning fires detected by class of people making discovery and average elapsed time from origin to detection. Region One, USFS, 1946-1973.

Forest Group & Decade		Lookout[1]	Patrolman	Other For. Ser.	Cooperator	For. Ser. Permitee	Air[1] Observer	Infrared	Other
Northwest									
1940	Percent	62.9	1.0	13.6	5.3	1.2	7.2		8.8
	Average Detection Time (hours)	18.37	19.25	22.64	12.77	17.87	22.03		18.12
1950	Percent	45.6	1.5	13.5	3.2	4.0	21.0		11.2
	Average Detection Time (hours)	17.79	20.44	22.88	18.06	23.19	22.32		17.04
1960	Percent	46.5	1.3	14.1	1.8	6.2	19.4		10.6
	Average Detection Time (hours)	17.04	29.25	25.05	18.51	23.50	28.60		20.71
1970	Percent	37.0	2.6	15.9	1.3	5.8	25.7	0.1	11.6
	Average Detection Time (hours)	18.49	27.03	19.71	45.74	21.64	25.08	16.00	23.90
Northcentral									
1940	Percent	69.1	0.3	13.4	5.0	1.8			10.5
	Average Detection Time (hours)	19.88	21.00	22.15	16.71	11.86			19.10
1950	Percent	51.7	0.7	13.8	6.9	2.4	15.7		11.1
	Average Detection Time (hours)	18.28	34.57	21.57	17.89	19.80	30.97		17.07
1960	Percent	45.3	0.7	13.6	4.0	4.5	23.5		8.4
	Average Detection Time (hours)	17.04	30.19	25.19	21.67	18.02	24.70		17.31
1970	Percent	41.4	1.8	9.7	1.2	4.7	29.5	0.5	11.2
	Average Detection Time (hours)	15.15	13.49	18.37	10.72	23.58	19.80	14.52	19.87
Southwest									
1940	Percent	66.9	0.6	16.9	2.8	2.3	4.9		5.7
	Average Detection Time (hours)	16.44	28.50	22.93	18.20	19.76	27.90		17.83
1950	Percent	56.4	0.2	12.5	3.1	1.2	23.5		3.1
	Average Detection Time (hours)	15.73	21.25	21.56	15.86	29.52	24.82		16.67
1960	Percent	44.2	0.5	9.9	1.3	1.6	28.9		3.5
	Average Detection Time (hours)	11.44	15.03	19.58	16.43	19.94	18.68		18.97
1970	Percent	53.6	0.6	10.4	0.6	2.7	26.7	1.8	2.9
	Average Detection Time (hours)	11.35	28.39	16.06	20.18	13.48	20.68	40.45	19.19
Northeast									
1940	Percent	26.9	0.6	14.0	17.0	10.4	6.3		24.8
	Average Detection Time (hours)	21.53	6.50	28.11	16.84	20.60	27.10		17.06
1950	Percent	23.5	0.6	11.4	15.9	10.7	13.3		24.8
	Average Detection Time (hours)	17.42	8.15	25.72	12.45	15.67	23.76		16.51
1960	Percent	24.6	0.9	9.2	7.8	6.4	28.5		22.6
	Average Detection Time (hours)	14.82	20.99	22.25	13.96	14.87	21.04		13.82
1970	Percent	23.6	1.1	10.4	14.0	7.6	20.0		23.2
	Average Detection Time (hours)	16.41	17.60	23.94	13.57	16.89	21.72		15.45
Southeast									
1940	Percent	16.7	0.8	13.4	17.5	27.6	1.6		22.4
	Average Detection Time (hours)	15.90	26.00	21.61	14.21	18.18	17.75		15.62
1950	Percent	19.8	1.4	11.3	16.5	27.6	2.4		21.0
	Average Detection Time (hours)	16.15	19.55	12.63	18.27	15.43	27.27		17.63
1960	Percent	23.8	1.1	12.9	6.2	25.11	13.0		17.9
	Average Detection Time (hours)	10.13	12.40	15.33	13.14	10.61	22.91		17.61
1970	Percent	21.9	2.3	10.5	4.7	24.9	20.2		15.5
	Average Detection Time (hours)	7.47	24.94	23.76	7.63	8.01	17.91		17.47

[1] Includes both USFS and non-USFS detections

IV-2. Initial Attack

The initial attack force has evolved from the single lookout-smokechaser to a faster, more powerful mixture of men and equipment. A prime example is the Southeast group of forests in Region One. In the decade of the 1960's, 87 percent of the fires were attacked initially by a ground force with handtools (Table IV-2), during the first 4 years of the 1970's this percentage dropped to 65 (Table IV-3). Ground tankers accounted for a considerably larger portion of the first attacks in the 1970's.

With the revision of the Individual Fire Report Form each decade, the criteria for determining first reinforcement also were revised. The criteria for each decade are as follows:

1940's - "...the first supplemental force that arrived on the fire 3 minutes or more after the first attacking force." (Individual Fire Report Handbook, USFS, 1940).

1950's - "...the first effective supplemental force to arrive at the fire before control but more than 15 minutes after the arrival of the first forces." (Individual Fire Report Handbook, USFS, 1950).

1960's - "...the first supplemental force that arrived more than 15 minutes after attack...but prior to control." (Individual Fire Report Handbook, USFS, 1960).

1970's - "... the first supplemental force that arrived more than 5 minutes after attack...but prior to control." (Individual Fire Report Handbook, USFS, 1970).

These three definitions of First Reinforcement make comparisons between decades meaningless. Within decades, appreciable differences are not evident, between forest groups, for the percent of fires needing re-

inforcement by size class. Table IV-4 presents the number of fires with a first reinforcement reported compared to the total number of fires.

Table IV-2. Number of Fires by Type of First Attack, Region One, USFS, 1960-1969.

Forest Group & Size Class	Type of First Attack: Dozer	Plows & Trenchers	Ground Tanker	Ground Force w/ Handtools	Helicopter Tanker	Airplane Tanker	Smoke-jumper	Helitak
Northwest								
A	2		85	1735		9	113	87
B	1	2	13	188		25	21	11
C			3	10				1
D	1		1					
E				2				
F				1				
G	1			1				
Northcentral								
A	5		134	1647		24	281	17
B	3		24	257		41	48	2
C	1		2	23		3	1	1
D			1	4			1	1
E				1				
F				1				
Southwest								
A	6	6	23	1826		31	685	423
B	6	1	5	253		57	164	79
C			1	23		14	14	11
D			1	4			3	1
E				7		1	3	
F				7		1	1	3
G				1				1
Northeast								
A	4		40	605		22	46	2
B	1		5	126		41	8	
C	2		3	15		5	2	
D			1	2				
E				1				
F				2		1		
Southeast								
A	1	1	34	456		3	26	3
B		2	21	229		12	4	
C		1	2	47		2	3	
D				11				
E				4				
F				4				
G				2				

Table IV-3. Number of Fires by Type of First Attack, Region One, USFS, 1970-1973.

Forest Group & Size Class	TYPE OF FIRST ATTACK: Dozer	Plows & Trenchers	Ground Tanker	Ground Force w/ Handtools	Helicopter Tanker	Airplane Tanker	Smoke-jumper	Helitak
Northwest								
A		1	45	521		7	25	25
B	1		5	39		10	11	3
C				4		4	1	
Northcentral								
A	8	1	91	754		38	75	117
B	3		17	98		31	13	16
C	1		1	8		4	1	
D			1					
E			1	1				
F				2		1		
Southwest								
A	2	2	37	719	1	28	272	409
B	1		8	60		27	33	46
C			1	4		8		4
D						1		
E						1		
F				2				
G								1
Northeast								
A	1		28	212		6	20	1
B	1		4	58		15	4	2
C			3	7		7		
D								
E								
F				1		1		
Southeast								
A	2		34	143		3	17	8
B	1		38	60		6	3	
C			7	12		3		1
D			1	2				
E				1				

IV-3. Fire Suppression

Suppression of lightning fires requires large numbers of fire fighters. During the period 1950-1973 an average of 121 fire fighters were required per lightning fire. This figure is strongly influenced, of course, by the numbers of men required on large fires. Table IV-5. shows the average number of fire fighters used on lightning fires in each forest group during the 1950, 1960 and 1970 decades. For all Region One national forests the average number of fire fighters by size class of lightning fire was as follows:

Class	A[1]	4.00 fire fighters
"	B	13.86 " "
"	C	61.26 " "
"	D	154.30 " "
"	E or larger	371.84 " "

Eastern Zone national forests require fewer men per fire. During the period 1950-1973 the six Eastern Zone national forests used an average of 82.04 fire fighters per fire as compared to 151.58 in the Western Zone. The lower number of fire fighters per lightning fire in the Eastern Zone probably reflects the lighter fuels in this zone and their lower resistance to control.

Nearly one-fifth of all lightning fires require reinforcement action to achieve control. The number of fires requiring reinforcement action in each forest group is shown in Table IV-4. During the period 1950-1973

the percent of fires by size class requiring reinforcement action following initial attack in all Region One national forests was as follows:

Size Class	Percent Requiring Reinforcement
A	11.8%
B	45.5
C	69.1
D	58.2
E or larger	82.9
Average for all fires	18.4

Table IV-4 Number of fires requiring first reinforcement action compared with total number of fires, by size class of fire and forest group, Region One, USFS, 1946-1973.

Forest Group	Decade	A (1)	B	C	D	E+
Northwest	1940	0/1030	64/165	3/8	0/1	1/2
	1950	35/1561	13/182	3/17	2/3	0/1
	1960	359/2044	200/262	14/14	2/2	5/5
	1970	177/624	5/69	9/9		
Northcentral	1940	0/1061	74/201	5/14	1/1	0/1
	1950	29/1753	24/316	4/36	0/5	0/2
	1960	259/2118	240/376	31/31	8/8	2/2
	1970	269/1084	138/178	15/15	1/1	5/5
Southwest	1940	0/1117	35/132	4/11	0/2	0/2
	1950	49/2252	21/374	3/35	0/5	0/3
	1960	326/3003	330/566	59/64	9/9	25/25
	1970	284/1470	131/175	17/17	1/1	4/4
Northeast	1940	0/218	37/98	9/11	1/5	2/3
	1950	13/502	10/161	0/22	0/8	0/1
	1960	115/721	135/181	25/27	3/3	4/4
	1970	87/268	63/84	17/17		2/2
Southeast	1940	0/137	25/78	12/23	4/6	0/3
	1950	15/420	21/189	3/23	0/8	0/5
	1960	108/526	174/268	48/55	10/11	10/10
	1970	62/207	83/108	22/23	3/3	1/1

(1) Fire reports did not include data for Class A fires in 1940 decade.

Table IV-5. Average Number of Men Needed to Control Lightning Fires, Region One, USFS, 1950-1973.

	A	B	C	D	E	F	G
Northwest							
1950	NC[1/]	11	51	131	442		
1960	NC	13	67	195	405	600	1018
1970	4	14	112				
Northcentral							
1950	NC	34	52	208	349		
1960	NC	12	67	223	190	525	
1970	5	24	108	200	603	580	
Southwest							
1950	NC	7	49	126	261		
1960	NC	21	58	195	325	554	290
1970	3	11	75	247	200	398	600
Northeast							
1950	NC	8	76	103			
1960	NC	13	70	191	278	318	
1970	4	12	56			385	
Southeast							
1950	NC	8	21	55	117	200	
1960	NC	10	37	102	157	171	230
1970	4	10	20	30	100		

[1/] Number of men not coded for size class A fires in the 1950's and 1960's.

IV-4. Large Fires

In this study we have identified large fires as being any fire of Class D or larger size (100 acres or more). The main objective was to identify the patterns of occurrence, locations, and dates of burning within the Western and Eastern Zones of the region. In addition for the period 1950-1973 suppression man-power was determined (except for the two largest fires, Sleeping Child on the Bitterroot in 1961 and Sundance on the Kaniksu in 1967, because the man-power data was not available). Detailed analysis of control factors was not attempted because of lack of necessary data. We were primarily concerned with the impact of large fires on the overall lightning fire problem.

Large fires account for 94 percent of the area burned. During the 1946-1973 period a total of 163 class D or larger size fires burned 298,804 acres in Region One. Large fires occurred in every year except 1948, 1952, 1965 and 1971 (Tables IV-6 through IV-10). The peak occurrence years were:

1949	14 Class D or larger fires
1953	13 Class D or larger fires
1960	14 Class D or larger fires
1961	23 Class D or larger fires
1966	14 Class D or larger fires
1967	19 Class D or larger fires

The Western Zone has the greatest number of large fires. As shown in Table IV-11 a total of 90 class D or larger size fires burned 189,938 acres in Western Zone national forests. The greatest concentration of these fires is in the Southwestern group where 51 occurred. The Nezperce

National Forest had 27 large fires, more than double the number on any other Western Zone forest. The three forests with the largest area burned were the Kaniksu (82,184 acres), Bitterroot (42,797 acres) and Nezperce (39,088 acres).

Many large lightning fires have occurred in the Eastern Zone. A total of 73 class D or larger size fires burned 108,866 acres during the 1946-1973 period (Table IV-11). The greatest concentration of these fires in the Eastern Zone is in the Southeastern group of forests. The Custer National Forest led all Region One forests with a total of 32 large fires. These fires on the Custer burned 37,446 acres, the fourth largest burn in Region One.

Table IV-6 . Summary of Class D and Larger Fires in Region One National Forests, 1946-1949.

Year	Dates		National Forest	Size Class	Acres Burned
	Start	Control			
1946	8-4	8-5	Helena	D	130
	8-4	8-5	Kootenai	E	880
	8-5	8-5	Custer	D	200
	8-12	8-12	Nezperce	E	2460
	8-20	8-21	Lolo	D	139
	8-20	8-23	St. Joe	E	441
	8-21	8-21	Kaniksu	D	240
1947	5-6	5-7	Nezperce	D	120
	7-27	7-28	Beaverhead	D	170
	7-24	7-29	Beaverhead	D	245
	8-1	8-1	Bitterroot	G	5240
	8-7	8-8	Kaniksu	G	7250
	8-8	8-8	Deerlodge	D	120
	9-27	9-27	Custer	D	274
1949	4-17	4-17	Nezperce	D	115
	6-26	6-26	Custer	D	150
	7-1	7-1	Custer	D	110
	7-16	7-16	Deerlodge	D	118
	8-4	8-4	Deerlodge	F	3240
	8-4	8-4	Helena	G	6190
	8-5	8-7	Helena	G	35920
	8-9	8-9	Gallatin	F	3370
	8-10	8-10	Gallatin	E	310
	8-10	8-10	Gallatin	F	1100
	8-12	8-12	Custer	F	4350
	8-13	8-14	Lewis and Clark	D	147
	8-18	8-18	Deerlodge	D	232

Table IV-7. Summary of Class D and Larger Fires in Region One National Forests, 1950-1959

Year	Dates		National Forest	Size Class	Acres Burned	Personnel
	Start	Control				
1950	5-22	5-24	Kaniksu	D	125	37
	9-5	9-17	Gallatin	D	100	74
	9-5	9-5	Lolo	D	102	38
1951	8-1	8-6	St. Joe	D	119	107
	8-1	8-10	St. Joe	E	572	442
1953	7-19	8-10	Gallatin	F	1007	200
	8-1	8-5	Deerlodge	D	299	170
	8-8	9-20	Lewis & Clark	D	215	252
	8-12	8-25	Lolo	E	415	395
	8-13	8-31	Lewis & Clark	D	166	200
	8-16	9-15	Nezperce	F	1590	632
	8-18	9-2	Clearwater	D	150	64
	8-18	9-10	Nezperce	D	273	198
	8-18	9-5	Nezperce	E	580	150
	8-19	9-2	Nezperce	D	282	177
	8-24	8-28	Helena	D	159	104
	9-11	9-29	Beaverhead	D	266	179
	9-19	10-3	Deerlodge	D	171	67
1954	7-30	8-5	Custer	E	398	135
1955	8-16	8-16	Lewis and Clark	F	1355	(1)
	8-22	8-22	Custer	D	(1)	(1)
	8-23	8-23	Lewis and Clark	D	(1)	(1)
	8-31	9-5	Lolo	D	170	125
	9-5	9-8	Beaverhead	E	364	74
1956	6-9	6-9	Custer	D	(1)	(1)
	7-29	8-13	Kaniksu	D	200	250
	8-2	8-2	Lewis and Clark	D	115	(1)
	8-4	8-13	Custer	E	394	103
	8-5	8-6	Custer	D	111	23
	8-12	8-12	Custer	D	(1)	(1)
	8-17	8-25	Bitterroot	D	160	153
	8-19	8-19	Lewis and Clark	D	(1)	(1)
1957	8-12	8-22	Beaverhead	D	230	160
1958	5-29	5-29	Custer	D	(1)	(1)
	7-12	7-18	Kootenai	D	190	298
	8-11	8-14	Nezperce	D	120	39
	8-12	9-10	Flathead	F	1004	303
	8-14	8-28	Kootenai	D	227	344
	8-25	9-6	Kootenai	D	238	235
1959	8-1	8-1	Clearwater	E	(1)	(1)
	8-26	9-5	Custer	E	349	156

(1) Not entered on fire report

Table IV-8. Summary of Class D and Larger Fires in Region One National Forests, 1960-1964

Year	Dates		National Forest	Size Class	Acres Burned	No. of Personnel
	Start	Control				
1960	7-13	7-19	Lolo	F	3080	525
	7-16	7-17	Kootenai	D	173	416
	7-19	7-19	Nezperce	D	139	148
	7-19	7-20	Nezperce	F	1750	300
	7-19	7-22	Nezperce	G	5719	580
	7-20	7-22	Beaverhead	D	286	130
	7-20	7-22	Bitterroot	F	3050	1450
	7-20	7-20	Lewis and Clark	D	110	160
	7-21	7-21	Bitterroot	E	355	50
	7-23	7-23	Custer	D	140	60
	7-24	7-24	Custer	D	131	105
	7-24	7-24	Helena	D	270	360
	7-24	7-25	Lewis and Clark	E	335	278
	8-2	8-2	Custer	D	240	125
1961	6-28	6-28	Custer	D	232	125
	7-16	7-16	Beaverhead	D	162	96
	7-16	7-16	Bitterroot	D	290	385
	7-16	7-17	Custer	D	180	340
	7-27	7-27	Helena	F	2881	350
	8-4	8-11	Bitterroot	G	28002	2730
	8-4	8-6	Clearwater	F	1108	657
	8-4	8-13	Clearwater	F	3895	357
	8-4	8-13	Clearwater	F	2780	700
	8-4	8-7	Nezperce	F	1240	957
	8-15	8-15	Deerlodge	E	290	52
	8-15	8-19	Nezperce	F	4545	627
	8-15	8-18	Nezperce	E	365	207
	8-16	8-17	Nezperce	D	210	102
	8-17	8-18	Bitterroot	E	510	450
	8-22	8-22	Coeur d'Alene	D	163	150
	8-22	8-23	Lolo	D	197	164
	8-24	8-25	Clearwater	E	385	600
	8-28	8-28	Bitterroot	D	100	140
	8-28	8-29	Nezperce	E	810	531
	8-28	8-29	Nezperce	E	450	418
	8-29	8-29	Bitterroot	D	290	130
	8-29	8-29	Helena	F	1170	190
1962	7-20	7-21	Bitterroot	F	1765	575
	7-24	7-24	Kootenai	D	157	230
1963	8-4	8-5	Nezperce	E	480	280
	8-18	8-18	Custer	E	427	160
1964	7-12	7-12	Kootenai	D	150	240
	8-14	8-16	Beaverhead	F	1070	177

Table IV-9. Summary of Class D and Larger Fires in Region One National Forests, 1966-1969

Year	Dates		National Forest	Size Class	Acres Burned	No. of Personnel
	Start	Control				
1966	5-29	5-30	Nezperce	D	200	206
	6-19	6-19	Custer	D	163	38
	7-7	7-8	Custer	F	2086	177
	7-19	7-21	Custer	G	12832	274
	7-19	7-20	Custer	F	3283	206
	7-19	7-20	Custer	G	8112	185
	7-19	7-20	Custer	F	1229	124
	7-20	7-20	Custer	E	624	53
	7-20	7-21	Custer	E	384	54
	7-21	7-21	Custer	D	100	16
	7-29	7-30	Lewis and Clark	F	1033	414
	8-1	8-1	Gallatin	D	120	11
	8-16	8-16	Gallatin	E	510	360
	9-9	9-9	Custer	D	105	75
1967	8-8	8-15	Kootenai	E	670	190
	8-11	8-14	Flathead	D	124	100
	8-11	8-17	Kaniksu	E	695	500
	8-11	8-13	Kootenai	D	270	293
	8-11	9-5	Kaniksu	G	55910	2261
	8-12	8-14	Clearwater	D	144	290
	8-12	8-14	Clearwater	E	310	331
	8-12	8-13	Colville	E	490	310
	8-12	8-26	Kaniksu	G	16600	2036
	8-12	8-25	Nezperce	F	3000	52
	8-13	8-19	Kaniksu	F	1164	600
	8-14	8-15	Kootenai	D	133	212
	8-20	8-22	Clearwater	D	127	145
	8-20	8-22	Clearwater	D	168	210
	8-20	8-22	Clearwater	E	812	366
	8-20	8-21	Nezperce	E	760	200
	8-20	8-23	Nezperce	F	2420	325
	8-20	8-23	Nezperce	F	1570	201
	8-21	8-28	Nezperce	E	660	142
1968	8-5	8-8	Nezperce	F	3600	450
1969	6-15	6-15	St. Joe	D	101	239
	8-24	8-25	Flathead	D	270	130

Table IV-10. Summary of Class D and Larger Fires in Region One National Forests, 1970-1973.

Year	Dates		National Forest	Size Class	Acres Burned	No. of Personnel	
	Start	Control					
1970	8-23	8-23	Custer	D	105	18	
	8-24	8-25	Kootenai	F	1110	400	
	8-25	8-26	Lewis and Clark	F	3831	150	
	8-26	8-28	Lewis and Clark	F	3100	620	
	8-27	8-29	Kootenai	F	1172	583	
	9-2	9-2	Lolo	D	128	200	
1972	8-30	8-31	Lolo	E	730	623	
1973	8-3	8-3	Custer	D	207	63	
	8-3	8-4	Nezperce	E	580	200	
	8-10	8-10	Bitterroot	F	1200	95	(1)
	8-13	8-15	Bitterroot	D	155	247	
	8-13	8-13	Nezperce	G	5050	600	
	8-15	8-17	Bitterroot	F	1680	700	(2)
	8-15	8-19	Flathead	E	450	583	
	8-15	8-19	Kootenai	F	1925	759	
	8-20	8-20	Beaverhead	D	153	8	
	8-27	8-27	Custer	E	530	100	

(1) Fitz Creek fire in White Cap fire management unit of Selway - Bitterroot Wilderness Area

(2) Snake Creek fire which was an extension of the Fitz Creek fire burning outside of the White Cap fire management unit.

Table IV-11. Number of Large Fires and Area Burned by Zones, Groups and Individual National Forests, 1946-1973.

	No. of Class D or Larger Fires	Acres Burned
Western Zone		
Southwestern Group		
Bitterroot	13	42,797
Clearwater	11	9,879
Nezperce	27	39,088
Group Total	51	91,764
Northwestern Group		
Coeur d' Alene	1	163
Colville	1	490
Kaniksu	8	82,184
St. Joe	4	1,233
Group Total	14	84,070
North Central Group		
Flathead	4	1,848
Kootenai	13	7,295
Lolo	8	4,961
Group Total	25	14,104
Eastern Zone		
Northeastern Group		
Deerlodge	7	4,470
Helena	7	46,720
Lewis and Clark	12	10,407
Group Total	26	61,597
Southeastern Group		
Custer	32	37,446
Beaverhead	9	2,946
Gallatin	6	6,517
Group Total	47	46,908

Large lightning fires require mobilization of thousands of fire fighters. In peak fire load years 2000 to 10,000 suppression personnel are required to fight large fires (Tables V-6 to V-10). Peak years for mobilization of fire fighters were:

Year	No. of Class D or Larger Fires	No. of Suppression Personnel (1)
1953	13	2858
1960	14	4685
1961	23	10,458
1966	14	2193
1967	19	8764
1970	6	1971
1973	10	3355

(1) Includes only personnel mobilized to fight Class D or larger fires during the year. The total number of personnel were not mobilized at one time.

V. CRITICAL LIGHTNING FIRE SITUATIONS

Occasional great peaks in fire occurrence, area burned and control requirements are an exceedingly important characteristic of lightning fires. Natural resource and fire managers have long recognized these features of the lightning fire problem. The word "critical" has often been used to describe the periods, years or locations of great outbreaks of lightning fires. In this study we have focused efforts on a definition of critical lightning fire situations and on analysis of their significant features.

V-1. Definition of Critical Lightning Fire Situations

It has often been said that "beauty is in the eyes of the beholder." The same may be said for critical lightning fire situations. What is critical to one person or group of persons may not be judged in the same way by others. We recognize the complexity of precisely defining a critical lightning fire situation. However, the wealth of data now available on lightning fires does permit identification of those specific situations placing a critical load on fire management organizations or producing severe impacts on natural resources and society.

Critical lightning fire situations involve many factors and dimensions. These include:

(1) Time span -- single day, series of days, month, year.

(2) Location -- individual national forests, groups of forests, zones, total region.

(3) Values at stake -- timber, forage, wildlife, watersheds, recreation areas, scenic beauty, developed facilities, industries, communities, air and water pollution control, public safety.

(4) Fire occurrence -- numbers of fires by size class, time and location.

(5) Fire weather and fire danger rating -- at time of occurrence and following occurrence.

(6) Acres on fire -- by time and location.

(7) Fire control requirements -- personnel, equipment, supplies, transportation.

(8) Costs -- fire control, damage.

Complex interrelationships exist between each of these factors and their dimensions. Because of this complexity and the lack of appropriate data on many items no attempt is made to use all of the factors in developing definitions for critical situations. The available data on specific outbreaks of fires when examined in specific time periods and locations can provide a useful basis for critical definitions. In the future when additional data is available these definitions can be further examined and refined.

Fire management experience indicates that strictly from a fire viewpoint (exclusive of resource values and social concerns) the following are ingredients in a critical situation:

(1) Buildup. A period of dry weather makes fuels become highly flammable.

(2) Fire Occurrence. Combinations of large numbers of fires in a short time period (1 to 3 days) or continued new ignitions over longer periods requiring full deployment of the available initial attack forces.

(3) Fire Weather. The weather conditions during and immediately following fire ignitions provide a high potential for fire spread.

(4) Large Fires. The existence of class D or larger fires requires a massive deployment of fire suppression forces recruited primarily from external sources.

Our analysis of lightning fires in Region One indicates that all four of these ingredients must be present to generate a critical situation. For example:

(1) Buildup (highly flammable fuels) is a dangerous situation, but is only a threat until fires occur.

(2) Large numbers of fires even in the absence of buildup and severe fire weather can result in large scale deployment of fire attack forces. However, the experience in Region One shows that fire management organizations have been able to effectively handle situations where the only critical ingredient is large numbers of fires.

(3) Large numbers of lightning fires may not create a critical situation if precipitation during and following the storm lowers fuel flammability. On the other hand severely dry and windy weather following ignitions can cause a high potential for a critical situation.

(4) Large uncontrolled fires impact the overall fire management organization including commitment of fire suppression resources and the continuing availability of forces to attack new fires that may occur during the periods when existing fires are being fought.

In defining critical lightning fire situations consideration also is given to the size of the area that may be impacted. The great mobility of modern fire fighting organizations strongly influences this factor. An individual national forest at some period of time may have each of the four ingredients of a critical lightning fire situation (buildup, fire occurrence, severe fire weather and large fires) and yet the result may be less than a critical situation. Other fire fighting forces within the region or available from outside the region can most often prevent full development of a critical situation. Our studies indicate that virtually every truly critical situation was of a multi-forest, regional or inter-regional dimension. The exception may be extremely violent weather on an existing large fire such as the Sundance fire of 1967 (Anderson, 1968).

V-2. Analysis of Peak Lightning Fire Loads

As explained in the previous chapter the peak load factors of total fire occurrence, numbers of large fires and area burned are ingredients in a critical lightning fire situation. In this study we present data for each of these factors to permit judgements in identification of critical situations. Analyses of the specific weather factors related to critical situations are beyond the scope of this study. However, we have identified specific time periods and locations of peak loads which can be related to future studies of both lightning and weather factors.

Peak Single Day Fire Loads

Peak single day occurrence in the Region exceeds 200 fires. During the 1946-1973 period there were five days when more then 200 lightning fires occurred (Table V-1). On three of these days (8-1-1959, 8-31-1970, 8-22-1973) the large number of fires did not result in a critical situation. Only one fire in a total of 801 fires on these three days spread to class D or larger size. On two of the days (8-15 and 8-24, 1961) the large numbers of new fires contributed to an already established critical situation as explained later in this chapter.

Peak single day occurrence on an individual national forest exceeds 40 fires. As shown in Table V-2 single day occurrence of more than 40 lightning fires on an individual national forest was recorded 16 times. All of these national forests are in the Western zone. Two of the peak occurrence days (Nezperce, 8-15-1961, and 8-20-1967) were important ingredients in a critical situation. The all time peak occurrence on an

individual national forest of 108 lightning fires (8-31-1970) on the Clearwater obviously created a large scale requirement for critical attack manpower. However, our overall evaluation of this day did not place it in the critical category.

The Southwestern group has the greatest number of peak occurrence days. During the 1946-1973 period peak single day loads of more than 40 fires were recorded 8 times in this group (Table V-2). The Nezperce National Forest in this group with five peak occurrence days led all Region One forests in this category. The number of peak occurrence days on all forests in the Western Zone was as follows:

Southwestern Group	No. of Days
Bitterroot	0
Clearwater	3
Nezperce	5
Northwestern Group	
Coeur d'Alene	0
Colville	0
Kaniksu	0
St. Joe	3
North Central Group	
Flathead	1
Kootenai	2
Lolo	2

Three or more large fires in the Region start in a single day. During the 1946-1973 period there were 13 days when three or more class D or larger lightning fires were ignited (Table V-3). The peak days for large fire occurrence were:

Date	No. of Large Fires
August 4, 1961	5
August 19, 1966	4
August 11, 1967	4
August 12, 1967	5
August 20, 1967	6

Table V-1. Number of Lightning Fires by Size Class and Area Burned on Peak Fire Occurrence Days, Region One, 1946-1973.[1]

Date	Size Class					Total Fires	Acres Burned
	A	B	C	D	E+[3]		
8-1-1959	160	41	3	0	1	205	189[2]
8-15-1961	183	32	2	1	2	220	5294
8-24-1961	158	43	7	0	1	209	556
8-31-1970	317	38	1	0	0	356	25
8-22-1973	200	33	7	0	0	240	295

(1) Includes only days with more than 200 fires. Acres burned data show total area burned from fires starting on indicated date.

(2) Incomplete data for area burned by class E fire.

(3) Includes all fires of 300 acres or more in size.

Table V-2. Number of Lightning Fires by Size Class and Area Burned on Peak Fire Occurrence Days in Individual National Forests, 1946-1973.[1]

Date	National Forest	Size Class A	B	C	D	E+[3]	Total Fires	Acres Burned
8- 7-1947	Kootenai	49	7				56	22
8- 1-1959	Clearwater	33	6	1		1	41	13[2]
8- 1-1959	Lolo	42	7				49	15
8- 1-1959	Nezperce	32	11	1			44	40
7-14-1960	Kootenai	46	17	1			64	57
8-15-1961	Nezperce	52	10	1		2	65	4937
8-28-1961	Nezperce	35	5			2	42	1266
8- 4-1963	St. Joe	79	6				85	3
8-12-1963	St. Joe	51					51	0
8-20-1967	Nezperce	27	16	3		3	49	4886
8-31-1970	Clearwater	90	18				108	0
8-31-1970	Lolo	57					57	0
8-31-1970	St. Joe	59	11	1			71	25
8-22-1973	Clearwater	37	4	1			42	26
8-22-1973	Nezperce	73	13	2			88	101
8-23-1973	Flathead	41	1	1			43	26

(1) Includes only days with more than 40 fires on an individual national forest.

(2) Incomplete data on class E fire.

(3) Includes all fires of 300 acres or more in size.

Table V-3. Regional Occurrence of Three or More Class D or Larger Fires in a Single Day Showing Location and Acres Burned.

Date	National Forest	SIZE CLASS D	E	F	G	Total Class D or Larger	Acres Burned
8-18-1953	Clearwater	1				1	150
" " "	Nezperce	1	1			2	853
7-19-1960	Nezperce	1		1	1	3	7608
7-20-1960	Beaverhead	1				1	286
" " "	Bitterroot			1		1	3050
" " "	Lewis & Clark	1				1	110
7-24-1960	Custer	1				1	131
" " "	Helena	1				1	270
" " "	Lewis & Clark	1				1	335
7-16-1961	Beaverhead	1				1	162
" " "	Bitterroot	1				1	290
" " "	Custer	1				1	180
8-4-1961	Bitterroot				1	1	28002
" " "	Clearwater			3		3	7783
" " "	Nezperce			1		1	1240
8-15-1961	Deerlodge	1				1	290
" " "	Nezperce		1	1		2	4910
8-28-1961	Bitterroot	1				1	100
" " "	Nezperce		2			2	1260
7-19-1966	Custer			2	2	4	25456
8-11-1967	Flathead	1				1	124
" " "	Kaniksu		1		1	2	56605
" " "	Kootenai	1				1	270
8-12-1967	Clearwater	1	1			2	454
" " "	Colville		1			1	490
" " "	Kaniksu				1	1	16600
" " "	Nezperce			1		1	3000
8-20-1967	Clearwater	2	1			3	1107
" " "	Nezperce		1	2		3	18880
8-15-1973	Bitterroot			1		1	1680
" " "	Flathead		1			1	450
" " "	Kootenai			1		1	1925

Individual national forests have 3 or more large fires in a single day. On five occasions 3 or more Class D or larger fires have occurred in a single day on individual national forests (Table V-3). These events have been recorded in both Western and Eastern Zone national forests as follows:

Western Zone	Date	No. of Large Fires
Nezperce	August 19, 1960	3
Clearwater	August 4, 1961	3
Clearwater	August 20, 1967	3
Nezperce	August 20, 1967	3
Eastern Zone		
Custer	July 19, 1966	4

Lightning Fires ignited in the region on a single day may cause more than 5000 acres to be burned. During the 1946-1973 period there were 12 days when lightning fire ignitions resulted in burns of more than 5000 acres (Table V-4). These "5000 plus" days accounted for the burning of 223,102 acres or 70 percent of the area burned in Region One during the 28-year period. These days exhibit many of the characteristics of critical lightning fire situations including multiple ignitions, high percentage of Class D or larger fires and requirements for large numbers of fire fighters. Fires started on five of the days caused burns of more than 20,000 acres. More than 23 percent of all Class D or larger fires occurring during the 28-year period were recorded during these 12 days.

Both Western and Eastern Zone national forests have peak burn days. During the study period, 7 Western Zone and 3 Eastern Zone national forests were involved in the "5000 plus" burn days (Table V-5). The dates shown are the dates of ignition and do not include the total periods from ignition to control. The total periods when the large fires were burning are shown in Tables IV-6 through IV-10 in Chapter IV. The six peak days when lightning fires caused the largest area burned were:

Date	National Forest	Area Burned
August 4, 1949	Deerlodge, Helena	9,500
August 5, 1949	Helena	35,928
August 4, 1961	Bitterroot, Clearwater Nezperce	37,140
July 19, 1966	Custer	25,557
August 11, 1967	Kaniksu, Flathead Kootenai	57,031
August 12, 1967	Clearwater, Colville Kaniksu, Nezperce	20,846

In the above data the Sundance fire on the Kaniksu is recorded as August 11, 1967, the date of its ignition. However, more than 50,000

Table V-4. Summary of Single Days When Lightning Fire Ignitions Caused More than 5000 Acres to be Burned, Region One, 1946-1973.

Date	No. of Fires By Size Class							Total Fires	Acres Burned
	A	B	C	D	E	F	G		
8-1-1947	44	3	0	0	0	0	1	48	5249
8-7-1947	90	20	1	0	0	0	1	112	7350
8-4-1949	50	22	3	0	0	1	1	77	9500
8-5-1949	17	3	0	0	0	0	1	21	35928
7-19-1960	14	13	2	1	0	1	1	32	7676
8-4-1961	8	7	5	0		4	1	25	37140
8-15-1961	183	32	2	1	2	1	0	221	5294
7-19-1966	13	9	3	0	0	2	2	29	25557
8-11-1967	74	16	0	2	1	0	1	94	57031[1]
8-12-1967	68	24	7	1	2	1	1	104	20846
8-20-1967	63	35	9	2	2	2	0	113	6243
8-13-1973	78	22	3	1	0	0	1	105	5288
Totals	702	206	35	8	7	12	11	981	223102

(1) Includes Sundance fire which had major run on September 1.

Table V-5. Area Burned By Class D or Larger Fires on Individual National Forests on Days When Lightning Fire Ignitions Caused More Than 5000 Acres to be Burned, Region One, 1946-1973.

Date	Acres Burned In Region On Indicated Date	Acres Burned By Class D or Larger Fires on Individual National Forests
8-1-1947	5,249	Bitterroot (5240)
8-7-1947	7,350	Kaniksu (7250)
8-4-1949	9,500	Deerlodge (3240), Helena (6190)
8-5-1949	35,928	Helena (35920)
7-19-1960	7,676	Nezperce (7608)
8-4-1961	37,140	Bitterroot (28002), Clearwater (7783), Nezperce (1240)
8-15-1961	5,294	Deerlodge (290), Nezperce (4910)
7-19-1966	25,557	Custer (25447)
8-11-1967	57,031 (1)	Kaniksu (56605), Flathead (124), Kootenai (270)
8-12-1967	20,846	Clearwater (454), Colville (490), Kaniksu (16600), Nezperce (3000)
8-20-1967	6,243	Clearwater (1107), Nezperce (4750)
8-13-1973	5,288	Bitterroot (155), Nezperce (5050)

(1) Includes Sundance fire on Kaniksu which started on this date although major run was on September 1.

acres of its final size of 55,910 acres burned on September 1. The date of September 1, 1967 should be recorded as the worst burning day during the 1946-1973 period.

Peak Multiple Day Fire Loads

Continuous ignition of large numbers of lightning fires may occur in a series of days. We analyzed periods when at least 17 fires occurred in the region every day without a break and when the total ignitions in a series of days exceeded 200 fires (Table V-6). There were 23 periods of 3 to 10 days when continuous lightning fire occurrence of this magnitude occurred in the region. During 8 of these periods more than 400 fires occurred. There were two periods when average daily occurrence was 125 or more fires for 4 days.

Peak loads of large fires may occur in two to five day periods. During the 1946-1973 period there were nine periods of two to five days when multiple occurrence of class D or larger fires caused burns of 6,000 to 79,000 acres. There were a total of 55 Class D or larger fires. This was 34 percent of all fires of this size during the 28-year study period (Table V-7).

Peak fire loads may last for more than 30 days. In the 28-year study period there are two classic examples of prolonged peak fire activity. In the month of August 1961 the regional fire load included 1344 lightning fires, 18 class D or larger fires and 47,556 acres burned (Figure V-1). In one three day period 377 fires occurred. In a four day period 499 fires occurred. Between August 4 and 29 there were only five days when large fires were under control. Another long term period of intense fire activity occurred from August 4 to September 10, 1967 (Figure V-2). During

this period the regional fire load included 876 lightning fires, 19 class D or larger fires and 87,265 acres burned. One or more large fires were burning out of control for 29 consecutive days. Both of these long term periods of peak fire activity fully meet the definition of a critical lightning fire situation.

Man-caused fires may compound critical lightning fire situations. This study has not concentrated on man-caused fires. However, it is recognized that before or during a break-out of lightning fires that man-caused fire situations may be a critical factor in overall fire management. A total evaluation of fire risk involving the same fire load factors presented in this research of lightning fires is needed.

Table V-6. Peak Fire Occurrence on Three or More Successive Days, Region One National Forests.(1)

Year	Period		No of Fires	No of Days	Daily Average No. of Fires
1946	7-29	7-31	229	3	76.33
	8-19	8-23	280	5	56.00
1949	8-15	8-23	460	9	51.11
1953	8- 3	8-10	499	8	62.37
	8-16	8-23	404	8	50.50
1954	8-12	8-16	234	5	46.80
1959	7-31	8- 3	305	4	76.25
1960	7-13	7-16	276	4	69.00
	7-19	7-24	269	6	44.83
1961	8-15	8-19	425	5	85.00
	8-22	8-25	499	4	124.75
	8-28	8-30	251	3	83.66
1962	7-24	8- 2	504	10	50.40
1963	8- 4	8- 7	280	4	70.00
	8-12	8-15	303	4	75.75
1966	9-11	9-14	221	4	55.25
1967	7-12	7-15	217	4	54.25
	8-11	8-13	226	3	75.33
1970	7-16	7-18	217	3	72.33
	8-31	9- 3	595	4	148.75
1971	8- 2	8- 6	293	5	58.60
1972	8-14	8-20	238	7	34.00
1973	8-22	8-24	403	3	134.33

(1) Includes only days with 17 or more fires and total occurrence of more than 200 fires in a series of days.

Table V-7. Summary of Two to Five Day Periods When Lightning Fire Ignitions Caused More Than 6000 Acres to be Burned, Region One, 1946-1973.

Dates	No. of Fires by Size Class							Total Fires	Acres Burned
	A	B	C	D	E	F	G		
8/4-6/1949	76	32	5	0	0	1	2	116	45,605
8/9-13/1949	126	11	3	1	1	3	0	145	9,128
7/19-21/1960	98	48	7	3	1	2	1	160	11,716
8/15-17/1961	314	54	4	2	3	1	0	378	6,094
7/19-21/1966	36	17	3	1	2	2	2	63	26,690
8/11-13/1967	161	49	7	3	3	2	2	227	79,064
8/20-21/1967	103	48	11	2	3	2	0	169	6,978
8/23-27/1970	46	18	6	1	0	4	0	75	9,507
8/13-15/1973	113	35	5	1	1	2	1	158	9,448
Totals	1073	312	51	14	14	19	8	1491	204,230

Lightning Fires August, 1961 -- Total Daily Occurrence and Burning Periods, Origin to Control, of Individual Class D or Larger Fires in Region One National Forests (1344 fires; 47,566 acres burned).

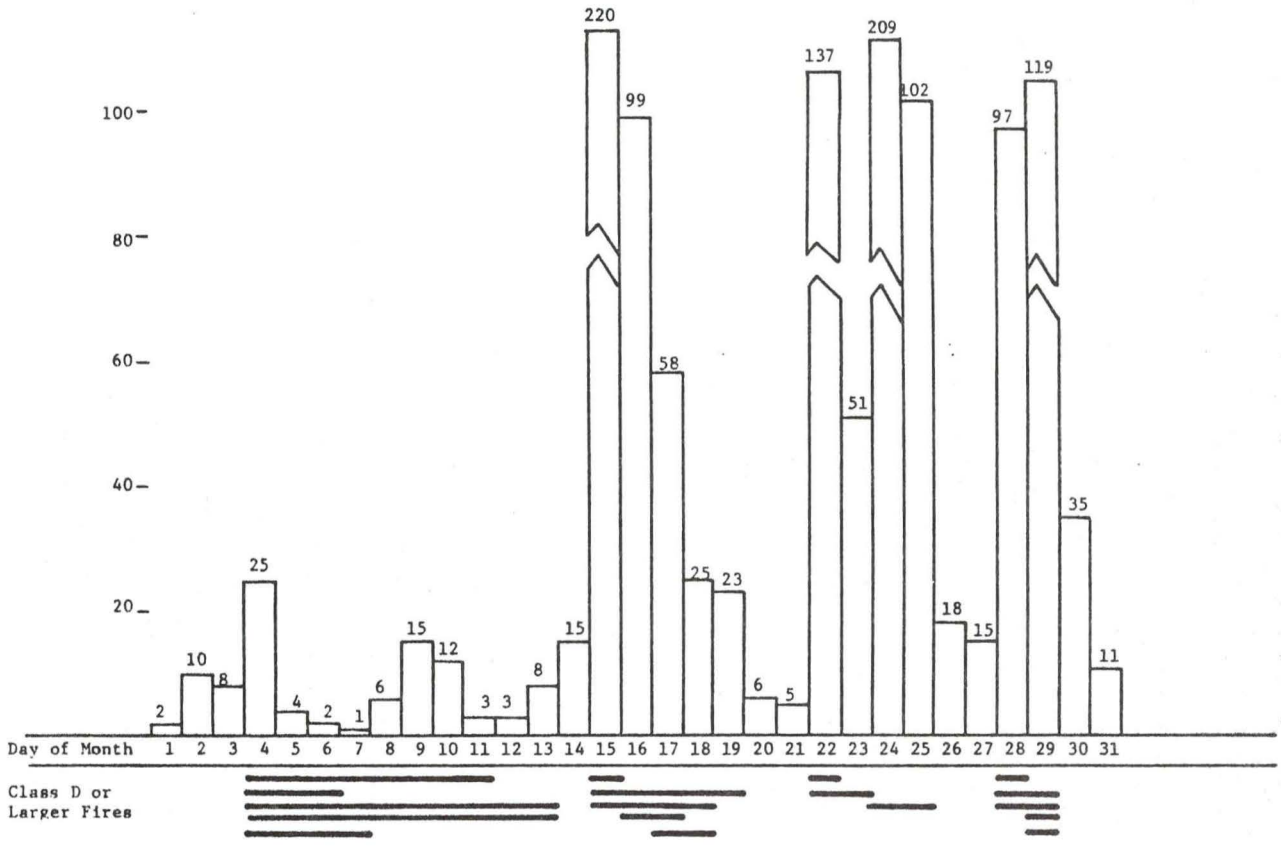

Figure V-1.

Lightning Fires August 4 to September 10, 1967 -- Total Daily Occurrence and Burning Periods, Origin to Control, of Individual Class D or Larger Fires in Region One National Forests (876 fires; 87,265 acres burned).

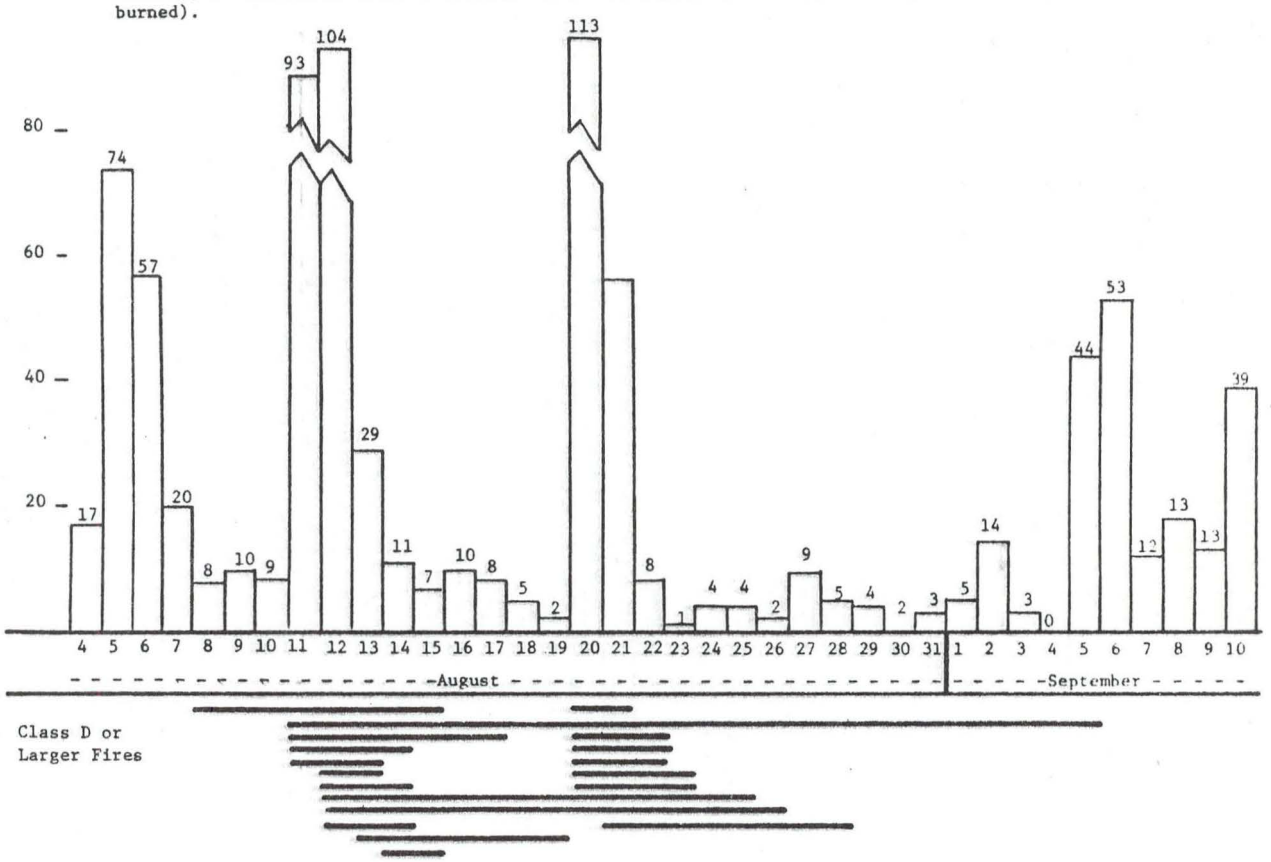

Figure V-2.

Summary of Critical Situations

Our analysis of lightning fires during the 28-year study period 1946-1973 shows that critical situations may occur in both the Western and Eastern Zones of the region and be of either short term or long term duration. The following periods appear to be the major candidates for designation as critical lightning fire situations:

Date	Total Fires	Class D or Larger Fires	Acres Burned	Center of Activity
		Single Day		
Aug 4, 1961	25	5	37,140	Bitterroot Clearwater Nezperce
Sept 1, 1967	(Major run of Sundance Fire)			Kaniksu
		Multiple Day		
Aug 4-5, 1949	116	3	45,605	Deerlodge Helena
Aug 9-13, 1949	145	5	9,128	Custer Gallatin Lewis & Clark
July 19-21, 1960	160	7	11,716	Bitterroot Nezperce
Aug 15-17, 1961	378	6	6,094	Bitterroot Nezperce
July 19-21, 1966	63	7	26,690	Custer
Aug 11-13, 1967	227	10	79,064	Clearwater Kaniksu Kootenai
Aug 20-21, 1967	169	7	6,978	Clearwater Nezperce
Aug 13-15, 1973	158	5	9,448	Bitterroot Flathead Kootenai Lolo Nezperce

Date	Total Fires	Class D or Larger Fires	Acres Burned	Center of Activity
		Long Term		
Aug 4-30, 1961	1313	18	47,556	Western Zone
Aug 4-Sept 5, 1967	794	19	87,265	Western Zone

VI. WILDERNESS FIRE ANALYSIS

Analysis of lightning fires in wilderness, primitive and wilderness study areas is of keen interest to fire research and fire management programs. Equally important is comparison of total wilderness and non-wilderness fire situations. The basic data presented in this report emphasize the importance of wilderness fires in Region One. During the 1950-1973 period, 13 percent of the lightning fires and nine percent of the area burned by lightning fires were in wilderness, primitive and wilderness study areas.

The information presented in this report should be considered only as a preliminary summary. The need to present total fire load factors and critical fire situations at specific times in both wilderness and non-wilderness areas is recognized. Moreover, it is recognized that total fire risk analysis including both lightning and man-caused fires is needed. Continuing research at Colorado State University is focused on these problems. A Ph.D. thesis and another report will address these important factors.

VI-1. The Historic Fire Load in Wilderness, Primitive, and New Study Areas

In this chapter we will discuss the magnitude of the fire load in each proposed or present Wilderness or Primitive Area, the classified area fire load in comparison to the total regional fire load, the impact of adding New Study Areas to the wilderness system, and the difference in character and potential of fires in classified versus non-classified areas.[1/]

Fifty-three classified areas[2/] in Region One comprise 5,256,785 acres.[3/] Of this, 3,345,881 acres are in present Wilderness and Primitive Areas.[4/] The locations of the areas are shown in Figure VI-1. Their exact area is listed in a later table (Table VI-7).

Some error exists in our designation of classified area fires. The boundaries of classified areas do not coincide with section or township boundaries, so an approximation was made in our analyses when we classified individual fires as being inside or outside of area boundaries. The legal description of individual fires that burned from 1950 to 1973 (22,524 fires; 237,930 known acres burned) was known only to the whole section in which it started. A fire was considered to be a classified area fire if the majority of the section in which it occurred is included in the classified area. A small bias exists in our reported fire density, and

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1/ The term "classified" is used to describe all designated Wilderness and Primitive Areas and New Study Areas.

2/ For this study, we considered the Grizzly Basin Study Area (5,500 acres) to be part of the West Side Swan-Monture New Study Area.

3/ USDA Forest Service. 1973. New wilderness study areas -- roadless area review and evaluation. Current Inform. Rep. No. 11, 21 p.

4/ USDA Forest Service. 1973. National Forest System -- Areas as of June 30, 1973. Washington, D.C. 20 p.

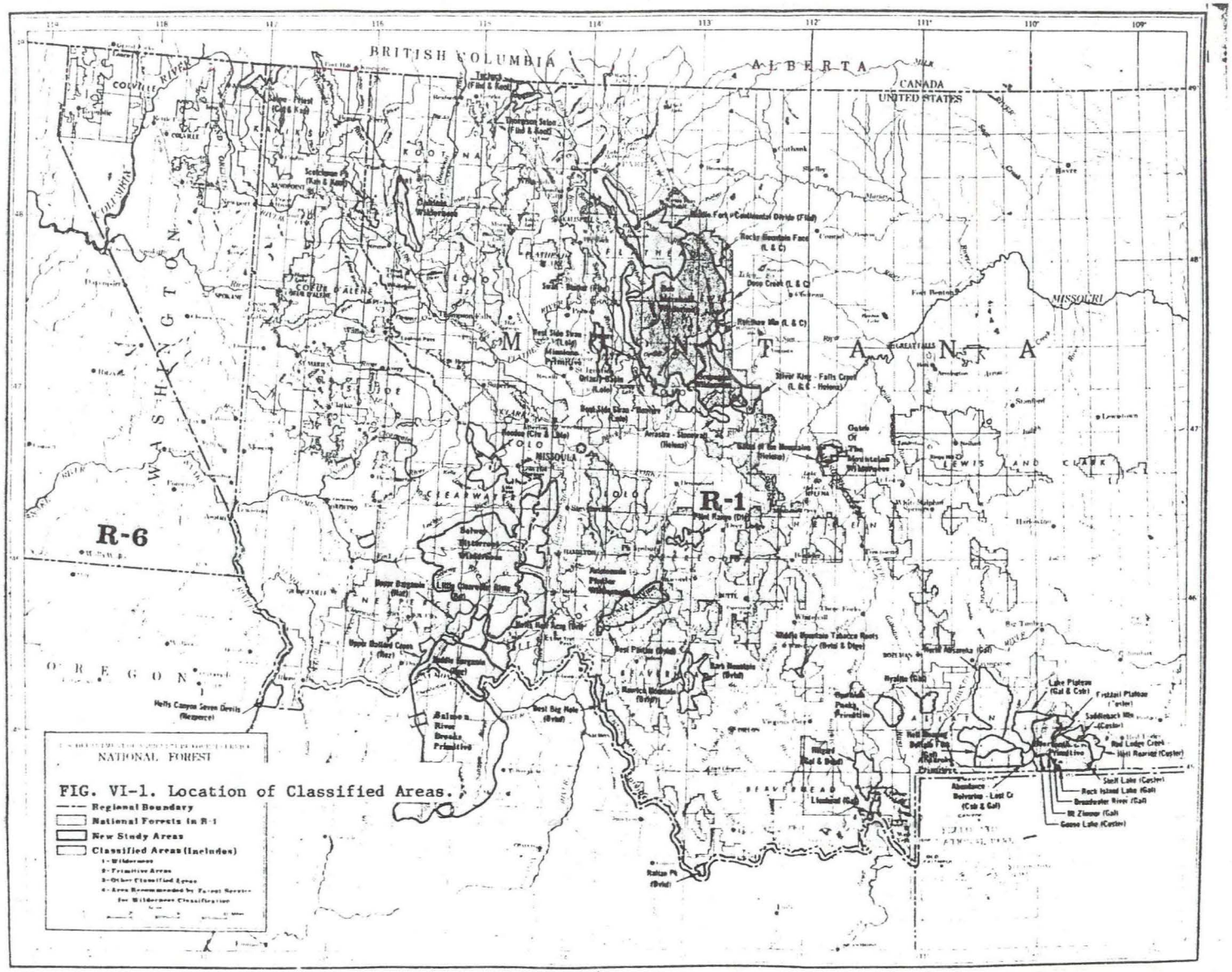

FIG. VI-1. Location of Classified Areas.

some errors both of inclusion and exclusion were made as a result of this imprecision. Fires originating within one-half mile of a classified area boundary, inside or outside, were subject to these errors.

The area burned in the Fitz (Fitz) Creek fire (1,200 acres) is included in our analysis of the fire load in the Wilderness Area, although that fire received a limited suppression effort. Its inclusion slightly biases our comparison of that Wilderness to other areas.

The location of fires are coded as the location of their ignition. The total area of a fire that started outside a classified area and spread into it was considered to be area burned in a non-classified area, while the total area of a fire that started in an area was considered to be area burned in the classified area.

A total of 3001 fires burned 23,446 acres in classified areas during the 24-year period. Fires within present Wilderness and Primitive area boundaries accounted for 2412 of those fires and 18954 of those acres burned.

The regional fire load in Wilderness and Primitive Areas, New Study Areas, and non-classified areas is shown in Table VI-1. The size class distribution in each year in each land-use classification is shown, along with the total number of fires and area burned per year. The total numbers of fires and areas burned for each decade are also given, along with the annual averages in each decade, the approximate distribution of fires per million acres per year and the cumulative size class distribution of fires.

There is no significant trend in the area burned per year nor in the distribution of fire sizes in any of the land use classifications. There is an apparent increase in the number of small fires over time, but that trend is most likely due to the increased efficiency of detection systems. The greatest area burned in all classifications occurred in the 1960's decade, due primarily to the very bad fire years of 1961 and 1967.

On the other hand, there has been a steady reduction in the average fire size and the percentage of fires reaching size classes B, C, D, and E in the New Study Areas only. No class D fires have occurred in these areas since 1963.

Fires within the present boundaries of Wilderness and Primitive areas accounted for 10% of all fires and 8% of the area burned. The annual fire load has ranged from 38 fires in 1950 to 314 fires in 1961 and from 0 acres in 1970 to 6267 acres in 1967.

Approximately 29 fires per million acres have burned 236 acres each year in Wilderness and Primitive areas. The average fire size has been 8.1 acres, with 2.6% of the fires exceeding ten acres in final size.

Fires within the present boundaries of New Study Areas accounted for 2% of all fires and 1% of the area burned. As many as 72 fires burned in 1973, but the greatest area burned was 1004 acres in 1958. Fire density is the lowest of any land use class, with 15 fires burning 74 acres per million acres per year. The average fire size has been 3.5 acres, with 4.5% of the fires greater than 10 acres in size.

Inclusion of all of the New Study Areas in the Wilderness system would decrease the density of fires to 24 fires burning 170 acres per million acres per year and reduce the average fire size to 7.1 acres. This compares to 39 fires burning 439 acres per million acres per year on all non-classified areas.

Table VI-1. Annual fireload, total fireload, average fireload, and size class distribution in classified and non-classified lands, Region I, 1950-1973.

Regional Analysis of Fireload

Date	Wilderness and Primitive A	B	C	D	E	Total	Acres	Wilderness Study A	B	C	D	E	Total	Acres	Non Wilderness A	B	C	D	E	Total	Acres	Regional Total A	B	C	D	E	Total	Acres
1950	33	5	0	0	0	38	4	4	0	1	1	0	6	115	431	52	0	2	0	485	258	468	57	1	3	0	529	377
1951	80	9	0	0	0	89	6	12	2	0	0	0	14	3	552	107	11	1	1	672	1117	644	118	11	1	1	775	1126
1952	56	13	0	0	0	69	17	12	2	1	0	0	15	16	455	86	5	0	0	546	290	523	101	6	0	0	630	323
1953	119	73	9	2	2	205	2449	23	7	2	2	0	34	520	841	232	38	5	2	1118	4677	983	312	49	9	3	1357	7649
1954	50	7	0	0	0	57	7	13	2	0	0	0	15	4	444	59	4	0	1	508	557	507	68	4	0	1	580	568
1955	25	8	1	1	0	35	216	8	8	3	1	0	20	69	501	59	5	1	2	568	1921	534	75	9	3	1	623	2206
1956	51	7	1	1	0	60	227	21	2	2	0	0	25	119	706	118	21	6	1	852	1548	778	127	24	7	1	937	1894
1957	68	16	0	0	0	84	14	16	1	1	0	0	18	23	541	105	6	1	0	653	451	625	122	7	1	0	755	488
1958	74	8	0	0	0	82	6	34	2	0	0	1	37	1004	805	131	11	5	0	952	1120	913	141	11	5	1	1071	2130
1959	54	16	3	0	0	73	82	8	2	0	0	0	10	2	391	83	8	0	2	484	728	453	101	11	0	2	567	812
1960	49	20	1	0	0	70	121	26	5	1	0	0	32	67	646	212	29	8	6	901	16932	721	237	31	8	6	1003	17120
1961	246	58	6	0	4	314	5429	43	9	5	2	0	59	589	1361	267	36	8	9	1681	46123	1650	334	47	10	13	2054	52141
1962	58	13	3	0	1	75	1887	33	11	0	0	0	44	14	678	110	4	1	0	793	473	769	134	7	1	1	911	2374
1963	138	20	4	0	0	162	172	33	4	0	0	1	38	488	1202	171	8	0	1	1382	1017	1373	195	12	0	2	1582	1677
1964	39	9	1	0	0	49	23	5	2	0	0	0	7	4	457	48	4	1	1	511	1357	501	59	5	1	1	567	1384
1965	64	6	0	0	0	70	6	9	4	0	0	0	13	7	413	53	0	0	0	466	71	486	63	0	0	0	549	84
1966	92	29	3	0	0	124	192	32	5	2	0	0	39	74	883	144	31	5	9	1072	32103	1007	178	36	5	9	1235	32369
1967	112	43	6	0	4	167	6267	47	7	2	0	0	56	89	934	226	30	6	9	1205	81200	1093	276	38	6	13	1426	87556
1968	30	8	1	0	0	39	52	15	1	0	0	0	16	1	402	75	5	0	1	483	3914	447	84	6	0	1	538	3967
1969	41	11	1	1	0	54	315	24	2	0	0	0	26	3	300	80	8	1	0	389	680	365	93	9	2	0	469	998
1970	92	13	0	0	0	105	0	24	2	1	0	0	27	31	1100	156	24	2	4	1286	9996	1216	171	25	2	4	1418	10027
1971	71	17	1	0	0	89	20	30	4	0	0	0	34	0	462	87	15	0	0	564	396	563	108	16	0	0	687	416
1972	75	17	1	0	0	93	31	29	3	0	0	0	32	4	769	106	6	0	1	882	991	873	126	7	0	1	1007	1026
1973	92	16	1	1	1	111	1411	55	13	4	0	0	72	149	854	180	28	2	6	1070	11760	1001	209	33	3	7	1253	13320
TOTALS BY DECADE																												
1950's	610	155	14	4	2	792	3028	151	28	8	4	1	194	1875	5667	1032	109	21	9	6838	12667	6428	1222	133	29	12	7824	17570
1960's	869	217	26	1	9	1122	14464	267	50	10	2	1	330	1336	6977	1386	155	30	36	8883	183870	8432	1653	190	33	46	10335	199670
1970's	330	63	3	1	1	398	1462	138	22	5	0	0	165	184	3185	529	73	4	11	3802	23143	3653	614	81	5	12	4365	24789
Total	1809	435	43	6	12	2312	18954	556	100	23	6	2	689	3395	15829	2947	337	55	56	19523	219680	18513	3489	404	67	70	22524	242029
ANNUAL AVERAGES BY DECADE																												
1950's	61	16	1.4	0.4	0.2	79	303	15	3	0.8	0.4	0.1	19	188	567	103	11	2.1	0.9	684	1267	643	122	13	2.9	1.2	782	1757
1960's	87	22	2.6	0.1	0.9	112	1446	27	5	1.0	0.2	0.1	33	134	698	139	16	3.0	3.6	888	18387	843	165	19	3.3	4.6	1034	19967
1970's	82	16	0.8	0.2	0.2	99	366	34	6	1.2	0	0	16	46	796	132	18	1.0	2.8	950	5786	913	154	20	1.2	3.0	1091	6197
Total	75	18	1.8	0.2	0.5	96	790	23	4	1.0	0.2	0.1	29	141	659	122	14	2.3	2.3	813	9153	771	145	16	2.8	2.9	938	10085
APPROXIMATE ANNUAL AVERAGE PER MILLION ACRES (BASED ON PRESENT AREAS -1973)																												
Total	22	5.4	.54	0.06	.15	29	236	12	2.1	.52	.10	.02	15	74	32	5.9	.67	.11	.11	39	439	30	5.6	.61	.11	.11	36	386
All Classified Areas Combined:								19	4.2	.53	.08	.11	24	177														
AVERAGE FIRE SIZE							8.14							4.86							11.26							10.75
All Classified Areas Combined:														7.45														
PERCENT OF FIRES EXCEEDING LOWER SIZE LIMIT OF EACH SIZE CLASS																												
Total	100	21	2.6	.78	.52	-	-	100	19	4.5	1.16	.29	-	-	100	17	2.3	.57	.29	-	-	100	18	2.4	.61	.31	-	-
All Classified Areas Combined:								100	21	3.1	.87	.47																

Comparison of Fire Environments in Classified vs. Non-Classified Areas

The burning environment of classified and non-classified areas was compared in two ways: 1) the distribution of fires within general cover types, fuel types, elevation zones, slope classes, aspects, fire danger classes and ten-day periods was compared and 2) the potential for large fires, i.e. the percentage of fires that have exceeded 10 acres when controlled, was compared for similar fire environment types, zones, classes, and periods. All classified areas were considered together for these analyses. The level of significance of differences between fire occurrence and fire potential in each fire environment category was tested.

The percentage of fires that exceed .25, 10, 100, and 300 acres in classified areas is in each case significantly greater (99% level) than on non-classified lands. This is in contrast to our observation earlier that the average size of fires in classified areas (7.45 acres) was 34% smaller than on non-classified areas (11.26 acres). The apparent contradiction is explained by the fact that very large (300+ acre) fires are, on the average, much smaller on classified areas. The broken topography, higher elevation, and discontinuity in fuels of the classified areas has mitigated against very large fires since 1950.

There has been no trend over time in the percentage of fires that reach each size class nor in the comparative potential in classified vs. non-classified areas. The percent of fires in each size class for each year since 1950 is shown in Figure VI-2. No evidence exists here to suggest that fire control has resulted in a greater potential for large fires.

There is a greater variation in large fire potential in classified than in non-classified areas. In periods of high potential for large

Percentage of All Fires that were Larger than 0.25, 10.0, 100, and 300 Acres for Classified and Non-Classified Areas, 1950-1973, Region One.

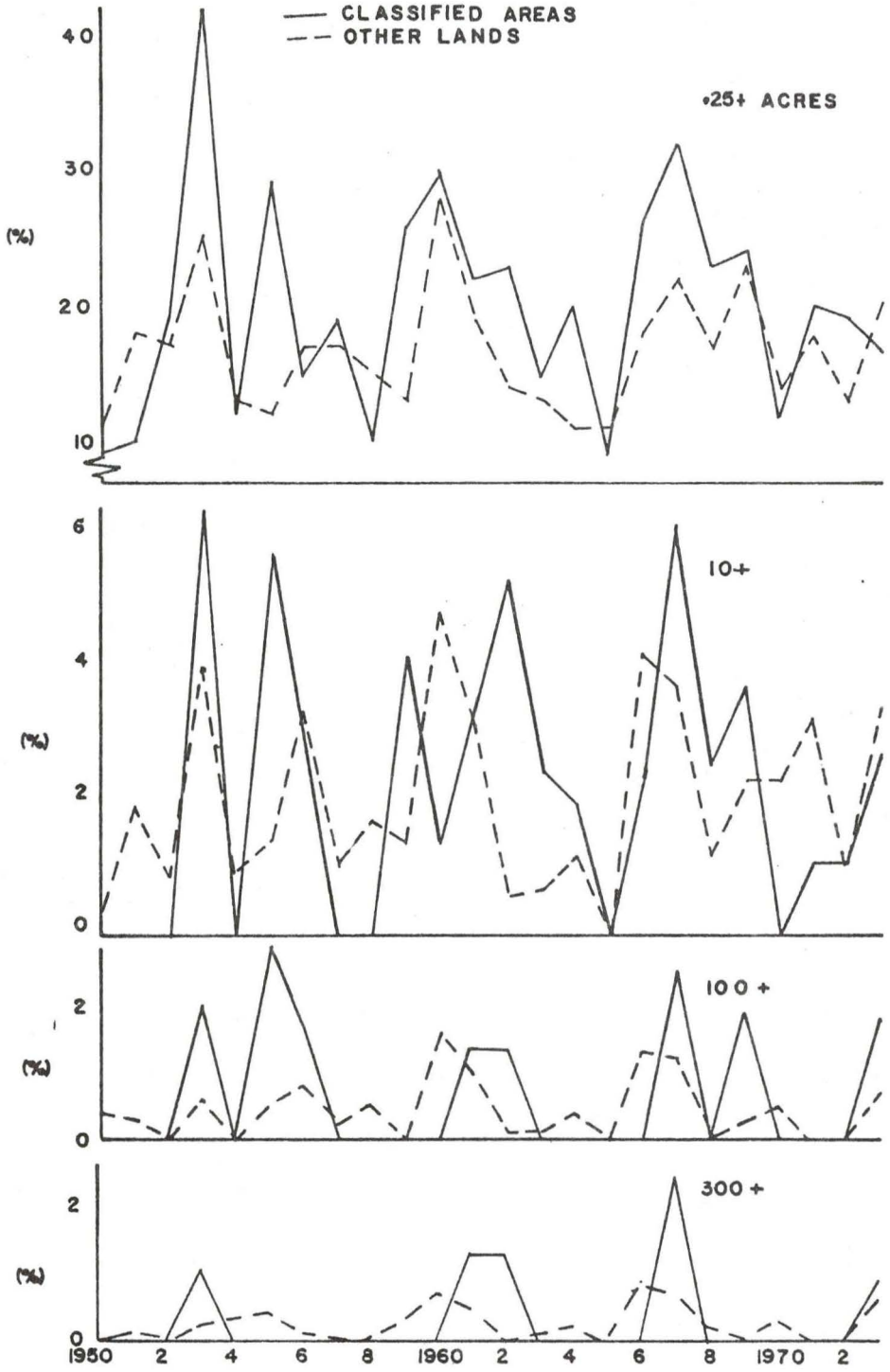

Figure VI-2.

fires in the region as a whole, such as in 1953, 1961 and 1967, the potential for large fires in classified areas is greater than in non-classified areas. In periods of lowest fire potential in non-classified areas, such as 1950, 1954, 1957-1959, 1964-1965, and 1970, the percentage of large fires in classified areas was even lower. The implication here for fire management is that the greatest potential for multiple large fire occurrences in wilderness areas occurs when fire suppression problems on non-wilderness lands are also the greatest.

The greatest proportion (26%) of fires in classified areas had their origin in the subalpine fir cover type (Table VI-2). Fires in the subalpine type accounted for only 7% of the fires on non-classified areas. A large proportion of the 3001 reported fires within the present boundaries of classified areas also occurred in lodgepole pine (15%) and Engelmann spruce cover types (8%), as compared to 11% and 5%, respectively, on non-classified areas. A lesser proportion of fires occur in ponderosa pine (16% vs. 24%), grand fir (5% vs. 12%), and fir-larch (2% vs. 7%) on classified vs. non-classified areas. Less than 1% of the fires in classified areas occur in white pine or cedar-hemlock cover types, as compared to 6% in each type on non-classified lands. All differences are significant at the 99% level. About an equal proportion of total fire starts (18% vs. 17%) occur in Douglas-fir in either land classification.

A significantly (95% level) larger proportion of fires in the ponderosa pine (5% vs. 3%) and subalpine (4% vs. 2%) cover types reached a size of 10 or more acres on classified than on non-classified lands.

Table VI-2 presents the number of fires in the 24-year period that have their origin in each of nine general cover types in classified (col. A) and non-classified (col. E). The percentage distribution of each is shown in columns (B) and (F). The number of fires that exceeded 10 acres

Table VI-2. Fire Occurrence and Potential by cover type in Classified vs. non-classified areas, based on 22500 1/ fires in Region 1 from 1950-1973.

	Classified Lands				Non-Classified			
	All fires		10 Acres+		All fires		10 Acres+	
Cover Type	Num (A)	% 2/ (B)	Num (C)	% 3/ (D)	Num (E)	% (F)	Num (G)	% (H)
Subalpine	767	26**	29	4*	1299	7	28	2
Douglas-fir	529	18	11	2	3340	17	70	2
Ponderosa	476	16	23	5*	4696	24**	139	3
Lodgepole	460	15**	14	3	2095	11	48	2
Engelmann	234	8**	13	6	887	5	26	3
Grand fir	149	5	0	0	2317	12**	14	1
Fir - Larch	54	2	0	0	1270	7**	14	1
Cedar-Hemlock	24	1	0	0	1170	6**	8	1
White Pine	22	1	1	5	906	5**	17	2

Footnotes:

1/ Fires starting only in the season May 1 to October 31
2/(Fires in cover type/all fires) x 100%
3/(Fires over 10 Acres/fires in cover type) x 100%
* denotes a significantly greater proportion at the 95% level
** denotes a significantly greater proportion at the 99% level

in each cover type is given in columns (C) and (G), and the percentage of fires that exceeded 10 acres in that cover type in columns (D) and (H). An asterisk or double asterisk is used to identify a significantly higher fire occurrence or large fire potential in either classified or non-classified areas.

The structure and interpretation of Tables VI-3 to VI-6 is identical to that explained above for Table VI-2.

Wilderness fires in low rate-of-spread and medium resistance-to-control fuels are more numerous and larger than on non-classified lands. A larger proportion of fires in classified areas occurred in low rate-of-spread fuels (40%) than on non-classified areas (27%). A significantly (99%) lesser porportion of fires occurred on classified lands in all other fuel classes. A greater proportion of fires in the low and medium rate-of-spread classes reached 10 acres in size on classified (3%) versus non-classified (2%) lands.

A greater proportion of fires occurred in the medium resistance-to-control fuel classification on classified versus non-classified lands (53% vs. 48%), and more of those fires exceed 10 acres in size (3% vs. 2%).

Wilderness fires occur at higher elevations and on steeper slopes than fires on non-classified lands. It is no surprise that a significantly higher proportion of fires in classified areas occur at elevations above 6000 feet than on non-classified lands (64% vs. 26%), or that a greater proportion occur on slopes greater than 59% (45% vs. 26%). There is no difference in the distribution of fires by aspect.

There are no important differences in the percentage of fires that exceed 10 acres on similar slopes or at similar elevations within and outside of classified areas. It is interesting to note that 50% of the fires greater than 10 acres in size in classified areas occur at a slope

Table VI-3 Fire Occurrence and Potential by fuel type, at origin, in Classified Vs. Non-Classified Areas, based on 22252 1/ fires in Region 1, 1950-1973.

	Classified Areas				Non-Classified			
	All fire		10 Acres+		All fires		10 Acres+	
	Num	%2/	Num	%3/	Num	%4/	Num	%
Rate-of-spread								
Low	1188	40**	31	3**	5224	27	48	1
Medium	1197	40	37	3**	9682	50**	184	2
High	544	18	21	3	4147	21**	146	4
Extreme	25	1	2	4	245	1	46	19
Flash	0	0	0	8	19	0	6	29
Resistance-to-Control								
Low	983	33	31	3	7398	38**	185	3
Medium	1588	53**	49	3**	9452	48	159	2
High	374	12	10	3	2391	12	73	3
Extreme	10	0	1	10	81	0	13	16

Footnotes

1/ fires starting from May 1 to October 31.
2/(fires in fuel type/all fires) x 100%
3/ (fires over 10 acres/fires in fuel type) x 100%
* denotes a significantly greater proportion (95%)
** denotes a significantly greater proportion (99%)
4/ percentages do not necessarily add up to 100% due to miscoded or non-coded records.

Table VI-4. Fire Occurrence and Potential by Slope and Elevation classes in Classified Vs. Non-Classified Lands, Based on 22475 fires in Region 1, 1950-1973. See Table VI-3 for footnotes.

	Classified Areas				Non-Classified			
	All fires		10 + Acres		All Fires		10 + Acres	
	Num	%	Num	%	Num	%	Num	%
Elevation Zone								
0 - 999	4	0	1	25	29	0	13	45
1000 - 1999	2	0	0	0	39	0	8	21
2000 - 2999	19	1	1	5	740	4**	25	3
3000 - 3999	110	4	4	4	3357	17**	95	3
4000 - 4999	303	10	10	3	5061	26**	104	2
5000 - 5999	597	20	12	2	5080	26**	77	2
6000 - 6999	887	30**	35	4**	3360	17	73	2
7000 - 7999	752	25**	23	3	1358	7	37	3
8000 - 8999	281	9**	6	2	404	2	12	3
9000+	46	2**	2	4	71	0	3	4
Slope Class								
0 - 9	164	5	4	2	1926	10**	46	2
10 - 19	225	8	1	0	2133	11**	41	2
20 - 29	279	9	2	1	2736	14**	37	1
30 - 39	338	11	9	3	3351	17**	54	2
40 - 49	227	9	18	7**	2109	11**	51	2
50 - 59	334	11	8	2	2175	11**	44	2
60 - 69	475	16**	19	4	2271	12	63	3
70 - 79	346	12**	12	3	1340	7	43	3
80 - 99	538	18**	21	3	1391	7	66	5
100+	25	1**	0	0	67	0	2	3

greater than about 63%, while the median slope at non-classified area large fires was only about 48%. It is apparent that slope steepness may explain part of the greater potential for fires to exceed 10 acres in classified lands.

Wilderness fires are more frequent and of greater potential on very high fire danger days than fires on non-classified areas. The proportion of fire occurrence on very-high and extreme fire danger days is greater on classified than non-classified lands (42% vs. 37%). The proportion of fires exceeding 10 acres is greater on classified lands on very high fire danger days (5% vs 3%).

More than one-half of all wilderness fires occur in August and 70% of large wilderness fires occur in August. The fire season on classified lands is much better defined than on non-classified lands. A significantly higher proportion of fires occur during the period August 1 to September 20 on classified versus non-classified lands (67% vs 58%). A significantly larger proportion of fires on classified lands exceed 10 acres in size only during the period August 11-20 (6% vs. 2%).

Table VI-5. Fire Occurrence and Potential by Fire Danger Adjective Rating Classes on Classified Versus Non-Classified Lands, Based on 22199[1]/ Fires in Region 1, 1950-1973. See Table VI-3 for Footnotes.

	Classified Areas				Non-Classified			
	All Fires		10 Acres +		All Fires		10 Acres +	
	Num	%[2]/	Num	%[3]/	Num	%[4]/	Num	%
Fire Danger								
Low	224	7	9	4	1620	8	43	3
Moderate	589	20	7	1	4235	22*	26	1
High	908	30	12	1	6236	32	77	1
Very High	833	28**	39	5*	4906	25	146	3
Extreme	418	14**	25	6	2230	11	129	6

Table VI-6. Fire Occurrence and Potential by 10-Day Period on Classified Vs. Non-Classified Lands, Based on 22500[1]/ Fires in Region 1, 1950-1973. See Table VI-3 for footnotes.

	Classified Areas				Non-Classified			
	All fires		10 Acres +		All fires		10 Acres +	
	Num	%[2]/	Num	%[3]/	Num	%[4]/	Num	%
Period								
5/1 - 5/10	2	0	0	0	35	0	1	3
5/11 - 5/20	1	0	0	0	46	0	2	4
5/21 - 5/31	22	1	1	5	273	1	5	2
6/1 - 6/10	23	1	1	4	299	2	4	1
6/11 - 6/20	16	1	0	0	332	2	8	2
6/21 - 6/30	44	1	2	5	647	3**	12	2
7/1 - 7/10	148	5	0	0	1265	6**	17	1
7/11 - 7/20	297	10	8	3	2179	11*	43	2
7/21 - 7/31	399	13	5	1	2750	14	59	2
8/1 - 8/10	506	17*	13	3	2960	15	74	3
8/11 - 8/20	616	21**	35	6**	3398	17	78	2
8/21 - 8/31	561	19**	18	3	3064	16	89	3
9/1 - 9/10	181	6	6	3	1103	6	36	3
9/11 - 9/20	156	5*	4	3	846	4	11	1
9/21 - 9/30	21	1	0	0	179	1	7	4
10/1 - 10/10	8	0	1	13	104	1	1	1
10/11 - 10/20	0	0	0	0	11	0	0	0
10/21 - 10/31	0	0	0	0	8	0	0	0

Fire Loads in Individual Classified Areas

The average annual fire load in each classified area is summarized in Table VI-7. The average number of fires in each size class, the average annual area burned, the number of fires and area burned per million acres per year, and the year of the peak loads in each area was computed. If the peak number of fires or area burned was equalled in two or more years, only the earliest year was listed.

The Selway-Bitterroot Wilderness Area had the greatest number of fires and area burned of all classified areas. An average of 64 fires burned 611 acres per year since 1950. If the Fitz Creek fire of 1973, a prescribed wildfire, and the related Snake Creek fire, were ignored, the annual average area burned would be 491 acres, still much higher than any other area. The Selway-Bitterroot has had by far the highest peak load with 247 fires in 1961 and 5561 acres in 1967.

The 51.9 fires per year per million acres have been exceeded only in two much smaller New Study Areas, the Gates of the Mountains (146 fires) and Hell's Half Acre (58 fires). The Salmon River Breaks Primitive Area, Gates of the Mountains Wilderness, and the Rock Island, Arrastra Stonewall, Gates of the Mountains, Little Clearwater River, and Salmo-Priest New Study Areas have all had a greater occurrence density than the 39 fires per million acres on non-classified lands.

The Selway-Bitterroot Wilderness has averaged 429 acres burned per million acres per year (396 acres if the Fitz Creek and Snake Creek fires were ignored), compared to 569 acres on the Salmon River Breaks Primitive Area. Several other areas have averaged a greater area density, but these were in all cases the result of one large fire in the 24-year period.

The fire load for each year on each classified area was computed. An example of this analysis for the Selway-Bitterroot is shown in Table VI-7a. The number of fires in each size class and the area burned is shown for each year in which a fire occurred. The average annual fire load and their overall size distribution is repeated here. A similar table for each classified area may be found in the appendix.

At least one fire has occurred during each year of record in the Selway-Bitterroot and Bob Marshall Wilderness Areas, and on the Hell's Half Acre Study Area.

TABLE VI-7.
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, R1, 1950-73.

AREA NAME	APPROX AREA (ACRE)	AVERAGE ANNUAL FIRE LOAD NUMBER BY SIZE CLASS A	B	C	D	E	TOTAL NUM	TOTAL ACRES	AVE LOAD / MM ACRES NUM	AVE LOAD / MM ACRES ACRES	PEAK FIRE LOAD NUMBER YR	PEAK FIRE LOAD NUMBER NUM	PEAK FIRE LOAD AREA YR	PEAK FIRE LOAD AREA ACRES
NON WILDERNESS	20869820	672.0	122.8	14.04	2.29	2.33	813.5	9453.	39.0	438.	61	1681	67	81200
ANACONDA PINTLAR WILDERNESS AREA	157803	2.1	.6	0.00	0.00	0.00	2.7	1.	17.2	5.	69	8	73	7
BOB MARSHALL WILDERNESS AREA	950000	8.3	1.4	.13	.13	0.00	10.0	33.	10.5	35.	73	27	53	422
CABINET WILDERNESS AREA	94272	1.6	1.0	.04	0.00	.04	2.6	31.	27.8	332.	53	21	67	672
GATES OF THE MOUNTIANS WILDERNESS AREA	28562	.6	.5	.13	0.00	0.00	1.2	6.	42.3	222.	50	3	60	87
SCAPEGOAT WILDERNESS AREA	239295	1.5	.3	0.00	.04	0.00	1.9	7.	7.8	30.	61	7	55	170
SELWAY BITTERROOT WILDERNESS AREA	1240618	51.3	11.7	1.04	.08	.33	64.4	611.	51.9	492.	61	247	67	5561
ABSAROKA PRIMITIVE AREA	64000	.3	0.0	0.00	0.00	.04	.3	42.	4.6	656.	56	2	53	1007
SPANISH PEAKS PRIMITIVE AREA	50516	.3	.1	0.00	0.00	0.00	.4	0.	7.4	4.	55	2	55	3
BEARTOOTH PRIMITIVE AREA	230000	.3	.0	0.00	0.00	0.00	.3	0.	1.4	1.	53	1	53	4
MISSIONS PRIMITIVE AREA	73945	1.4	.4	.04	0.00	0.00	1.8	4.	24.2	52.	53	7	53	86
SALMON RIVER BREAKS PRIMITIVE AREA	216870	7.9	2.4	.42	0.00	.08	10.7	123.	49.6	569.	67	35	62	1769
WEST BIG HOLE (NSA)	38369	.2	0.0	0.00	0.00	0.00	.2	0.	4.3	0.	62	2	0	0
ITALIAN PEAK (NSA)	9800	.0	0.0	0.00	0.00	0.00	.0	0.	4.3	0.	55	1	0	0
BARB MOUNTIAN (NSA)	52000	.3	.1	0.00	0.00	0.00	.4	0.	8.0	1.	63	2	60	1
MAURICE MOUNTIAN (NSA)	36625	.1	0.0	0.00	0.00	0.00	.1	0.	3.4	0.	52	1	0	0
LAKE PLATEAU (NSA)	77365	.0	.0	.04	0.00	0.00	.1	1.	1.6	18.	62	1	70	31
FISHTAIL PLATEAU (NSA)	24175	.1	0.0	0.00	0.00	0.00	.1	0.	3.4	0.	54	1	0	0
SADDLE BACK MOUNTIAN (NSA)	11306	0.0	.0	0.00	.04	0.00	.1	8.	7.4	663.	55	1	61	180
HELL ROARING RED LODGE CREEK (NSA)	42002	.1	0.0	0.00	0.00	0.00	.1	0.	2.0	0.	60	2	0	0
FLINT RANGE (NSA)	35269	.1	.0	.08	.04	0.00	.3	12.	8.3	334.	53	2	53	171
MIDDLE FORK CONTINENTAL DIVIDE (NSA)	302700	2.7	.5	0.00	0.00	0.00	3.2	1.	10.6	2.	62	11	60	6
SWAN BUNKER (NSA)	60000	.9	.0	.08	0.00	0.00	.9	3.	15.3	58.	66	4	73	75
TUCHUCK (NSA)	20640	.3	0.0	0.00	0.00	0.00	.3	0.	14.1	0.	63	2	0	0
THOMPSON SETON (NSA)	24200	.3	.1	0.00	0.00	.04	.4	42.	17.2	1730.	67	3	58	1004
MILGARD (NSA)	79000	.3	0.0	0.00	0.00	0.00	.3	0.	4.2	0.	53	2	0	0
HYALITE (NSA)	22268	0.0	0.0	.04	0.00	0.00	.0	1.	1.9	37.	56	1	56	20
NORTH ABSAROKA (NSA)	221044	.8	.2	.04	.04	0.00	1.0	8.	4.7	35.	73	6	50	100
LION HEAD (NSA)	18000	.0	0.0	0.00	0.00	0.00	.0	0.	2.3	0.	53	1	0	0
HELL ROARING BUFFALO FORK (NSA)	71606	.1	.0	.04	0.00	0.00	.2	1.	2.3	17.	72	2	61	26
ABUNDANCE WOLVERINE LOST CREEK (NSA)	20832	.2	0.0	.04	0.00	0.00	.3	4.	12.0	180.	56	2	56	90
ROCK ISLAND (NSA)	950	.0	0.0	0.00	0.00	0.00	.0	0.	43.9	0.	70	1	0	0
SILVER KING FALLS CREEK (NSA)	29700	.1	.1	0.00	0.00	0.00	.3	0.	8.4	4.	71	2	63	3
ARRASTRA STONEWALL (NSA)	9400	.4	.0	0.00	0.00	0.00	.4	0.	44.3	0.	58	3	0	0
GATES OF THE MOUNTIANS (NSA)	6000	.4	.5	0.00	0.00	0.00	.9	1.	145.8	139.	56	4	56	8
ROCK MOUNTIAN FACE CONTINENTAL DIVIDE (NSA)	62100	.1	.1	0.00	0.00	0.00	.2	0.	2.7	2.	55	2	67	2
RENSHAW MOUNTIAN (NSA)	26100	.2	.0	0.00	.04	0.00	.3	0.	9.6	0.	55	2	0	0
DEEP CREEK (NSA)	28900	0.0	0.0	.04	0.00	0.00	.0	2.	1.4	58.	53	1	53	40
SWAN MONTURE WEST SIDE (NSA)	107491	2.6	.5	.08	0.00	0.00	3.2	2.	29.5	22.	73	11	55	35
HOODOO (NSA)	157539	2.4	.5	.08	.04	0.00	3.1	12.	19.6	76.	62	10	61	247
SCOTCHMAN PEAK (NSA)	37020	.5	.0	.08	0.00	0.00	.7	2.	18.0	52.	71	3	73	33
LITTLE CLEARWATER RIVER (NSA)	66000	2.6	.3	.21	0.00	0.00	3.1	5.	46.9	80.	73	14	66	67
HELLS HALF ACRE (NSA)	71700	3.6	.5	.04	0.00	0.00	4.2	2.	58.1	22.	66	17	61	24
UPPER BARGAMIN (NSA)	28300	.9	0.0	0.00	0.00	0.00	.9	0.	30.4	0.	61	3	0	0
MIDDLE BARGAMIN (NSA)	12800	.5	0.0	0.00	0.00	0.00	.5	0.	35.9	0.	71	3	0	0
UPPER MALLARD CREEK	27000	.3	.1	0.00	.04	0.00	.4	12.	15.4	441.	53	3	53	284
HELLS CANYON SEVEN DEVILS (NSA)	36000	1.0	.2	.13	0.00	.04	1.4	23.	38.2	644.	67	7	63	480
SALMO-PRIEST (NSA)	25900	1.1	.1	0.00	0.00	0.00	1.2	0.	46.7	8.	58	10	73	4

Fire Environment in Individual Classified Areas

Important differences were found to exist in the fire environment of classified and non-classified areas, especially in regards to the cover type, fire danger adjective rating, and the fire season represented. Moreover, these environmental factors are important criteria in the decision matrix of a fire management program utilizing prescribed natural fires. For these reasons we described the occurrence of fire and the area burned under each of those coded environmental categories for each classified area.

The fire season for each classified area is described in the following tables which present the total number of fires (Table VI-8) and the total area burned (Table VI-9) in the 24-year period of record. For comparison, each table also shows the number of fires and area burned in non-classified areas. The area shown as non-wilderness does not include the area burned on private land within national forest boundaries during the 1950's decade. All other figures represent the final size of all fires, regardless of land ownership. This inconsistency, which results from a change in the coding instructions in 1960, results in a slightly different total than has been shown in earlier tables. These tables also exclude fires which started between October 11 and April 30, or for which the date of origin is unknown. No fires in classified areas were excluded in this way.

The fire season in classified areas is shorter than the fire season on non-classified lands. The Selway-Bitterroot area has the longest fire season as evidenced by at least one fire burning in each ten-day period from May 1 to October 10, followed by the Salmon River Breaks Primitive Area, with at least one fire in each 10-day period after May 21. However, the area burned in the two areas has been much more concentrated

TABLE VI.-7a.
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 6
SELWAY BITTERROOT WILDERNESS AREA
AREA=1240618 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
50	24	3	0	0	0	27	4
51	70	7	0	0	0	77	4
52	44	10	0	0	0	54	11
53	90	51	4	0	1	146	828
54	35	5	0	0	0	40	0
55	13	6	1	0	0	20	43
56	35	4	1	1	0	41	224
57	45	13	0	0	0	58	9
58	66	7	0	0	0	73	6
59	46	9	2	0	0	57	42
60	15	9	0	0	0	24	9
61	197	44	3	0	3	247	4526
62	34	6	3	0	0	43	116
63	104	15	3	0	0	122	131
64	21	6	0	0	0	27	8
65	47	4	0	0	0	51	5
66	68	15	1	0	0	84	32
67	58	25	5	0	3	91	5561
68	14	2	0	0	0	16	5
69	18	6	1	0	0	25	28
70	60	6	0	0	0	66	0
71	44	8	1	0	0	53	20
72	40	11	0	0	0	51	11
73	42	9	0	1	2	53	3051
TOT	1230	281	25	2	9	1546	14365
AVE	51.25	11.71	1.04	.08	.38	64.42	599.
PCT	79.56	18.18	1.62	.13	.58		
PCT	100.00	20.44	2.26	.65	.58		

FIRES PER MILLION ACRES PER YEAR 51.92
AREA BURNED 482.45

TABLE VI -6.
FIRE OCCURRENCE BY 10-DAY PERIOD, CLASSIFIED AREAS, REGION 1, 1950-1973
EACH AMOUNT REPRESENTS A 24-YEAR TOTAL

AREA CODE NUMBER AND NAME	MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCT.	TOTAL
	1-10	11-20	21-30	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-31	1-10	11-20	21-30	1-10	YEAR
10 NON-WILDERNESS	35	46	273	299	332	647	1265	2179	2750	2960	3398	3064	1103	846	179	104	19480
CATEGORY SUBTOTAL	35	46	273	299	332	647	1265	2179	2750	2960	3398	3064	1103	846	179	104	19480
1 ANACONDA PINTLAR WILDERNESS A	0	0	2	1	0	0	1	9	5	17	11	8	5	6	0	0	65
2 BOB MARSHALL WILDERNESS AREA	0	0	0	0	0	5	19	13	33	54	52	34	11	16	1	1	239
3 CABINET WILDERNESS AREA	0	0	0	0	0	1	0	10	2	8	20	19	2	0	1	0	63
4 GATES OF THE MOUNTIANS WILDER	0	0	2	1	1	0	3	4	5	8	3	2	0	0	0	0	29
5 SCAPEGOAT WILDERNESS AREA	0	0	0	0	0	2	0	6	6	7	9	13	0	2	0	0	45
6 SELWAY-BITTERROOT WILDERNESS	1	1	9	15	7	16	77	164	217	259	293	320	76	75	9	4	1544
20 ABSAROKA PRIMITIVE AREA	0	0	0	0	0	0	1	2	0	2	0	1	0	1	0	0	7
21 SPANISH PEAKS PRIMITIVE AREA	0	0	0	0	0	1	1	0	0	2	3	2	0	0	0	0	9
22 BEARTOOTH PRIMITIVE AREA	0	0	0	0	1	0	1	0	0	2	1	2	0	1	0	0	8
23 MISSIONS PRIMITIVE AREA	0	0	0	0	0	0	0	1	3	11	13	7	4	4	0	0	43
24 SALMON RIVER BREAKS PRIMITIVE	0	0	3	2	1	5	15	23	32	39	68	33	24	8	2	3	258
CATEGORY SUBTOTAL	1	1	16	20	12	30	118	232	303	409	473	441	122	113	13	8	2312
50 WEST FIO HOLE (NSA)	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0	4
51 ITACIAN PEAK (NSA)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
53 BAMB MOUNTIAN (NSA)	0	0	0	0	0	0	0	1	2	2	4	0	1	0	0	0	10
54 MAURICE MOUNTIAN (NSA)	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	3
55 LAKE PLATEAU (NSA)	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	3
56 FISHTAIL PLATEAU (NSA)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2
57 SADDLE BACK MOUNTIAN (NSA)	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
58 HELL ROARING-RED LODGE CREEK	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
61 FLINT RANGE (NSA)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	7
63 MIDDLE FORK CONTINENTAL DIVID	0	0	0	0	0	2	4	3	10	16	20	16	2	4	0	0	77
64 SWAN BUNKER (NSA)	1	0	0	0	0	2	2	1	2	0	8	0	0	5	1	0	22
65 TOCHUCK (NSA)	0	0	0	0	0	0	0	1	1	1	1	2	0	1	0	0	7
66 THOMPSON SETON (NSA)	0	0	0	0	0	0	0	0	1	2	4	2	1	0	0	0	10
67 MIDJAM (NSA)	0	0	0	0	0	0	2	0	1	1	1	2	0	1	0	0	8
68 HYALITE (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
69 NORTH ABSAROKA (NSA)	0	0	0	0	1	1	1	1	5	2	6	5	3	0	0	0	25
70 LION HEAD (NSA)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
71 HELL ROARING BUFFALO FORK (NSA	0	0	0	0	0	1	0	0	1	2	0	0	0	0	0	0	4
72 ABUNDANCE WOLVERINE LOST CREE	0	0	0	0	0	0	0	0	3	0	0	0	0	1	2	0	6
74 ROCK ISLAND (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
76 SILVER KING FALLS CREEK (NSA)	0	0	0	0	0	0	0	1	1	4	0	0	0	0	0	0	6
77 ARMASTRA STONEWALL (NSA)	0	0	0	0	0	0	0	0	0	2	3	1	1	3	0	0	10
78 GATES OF THE MOUNTIANS (NSA)	0	0	0	2	3	1	1	4	2	3	3	3	1	0	0	0	31
79 ROCK MOUNTIAN FALC CONTINENTA	0	0	0	0	0	1	0	0	0	0	2	1	0	0	0	0	4
80 HENSHAW MOUNTIAN (NSA)	0	0	0	0	0	0	0	0	1	1	1	2	0	1	0	0	6
81 DEER CREEK (NSA)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
82 SWAN MONTANE WEST SIDE (NSA)	0	0	0	1	0	1	1	14	8	16	12	12	5	6	0	0	76
83 HOUGOU (NSA)	0	0	0	1	0	0	3	8	16	9	14	12	9	1	1	0	74
84 SCOTCHMAN PEAK (NSA)	0	0	0	0	0	0	1	1	3	3	4	3	0	1	0	0	16
85 LITTLE CLEARWATER RIVER (NSA)	0	0	1	0	0	0	1	4	6	9	17	11	18	7	1	0	75
86 HELLS HALF ACRE (NSA)	0	0	5	0	0	4	9	12	12	8	17	15	10	7	1	0	100
87 UPPER BARGAMIN (NSA)	0	0	0	0	0	0	0	2	2	2	8	4	3	0	0	0	21
88 MIDDLE BARGAMIN (NSA)	0	0	0	0	0	0	1	0	2	2	2	1	2	1	0	0	11
89 UPPER MALLARD CREEK	0	0	0	0	0	0	0	1	0	1	4	3	1	0	0	0	10
90 HELLS CANYON SEVEN DEVILS (NS	0	0	0	1	0	0	2	4	6	7	2	8	1	2	0	0	33
91 SALMO-PRIEST (NSA)	0	0	0	0	0	0	0	3	5	1	8	11	0	0	1	0	29
CATEGORY SUBTOTAL	1	0	6	3	4	14	30	65	96	97	143	120	59	43	8	0	689
GRAND TOTAL	37	47	295	322	348	691	1413	2476	3149	3466	4014	3625	1284	1002	200	112	22481

TABLE VI - 9.
AREA BURNED BY 10-DAY PERIOD. CLASSIFIED AREAS. REGION 1. 1950-1973
EACH ARGUMENT REPRESENTS A 24-YEAR TOTAL

AREA CODE NUMBER AND NAME	MAY 1-10	MAY 11-20	MAY 21-30	JUNE 1-10	JUNE 11-20	JUNE 21-30	JULY 1-10	JULY 11-20	JULY 21-31	AUGUST 1-10	AUGUST 11-20	AUGUST 21-31	SEPTEMBER 1-10	SEPTEMBER 11-20	SEPTEMBER 21-30	OCT. 1-10	TOTAL YEAR
10 NON-WILDERNESS	70	135	314	97	511	654	2810	38297	12063	40643	40176	20416	57407	775	290	54	214712
CATEGORY SUBTOTAL	70	135	314	97	511	654	2810	38297	12063	40643	40176	20416	57407	775	290	54	214712
1 ANACONDA PINTLAR WILDERNESS A	0	0	3	0	0	0	0	0	0	9	0	6	1	0	0	0	19
2 BOB MARSHALL WILDERNESS AREA	0	0	0	0	0	2	8	6	10	259	210	277	3	13	2	1	791
3 CABINET WILDERNESS AREA	0	0	0	0	0	0	0	2	0	676	69	9	0	0	0	0	752
4 GATES OF THE MOUNTIANS WILDER	0	0	1	37	0	0	2	2	100	3	7	0	0	0	0	0	152
5 SCAPEGOAT WILDERNESS AREA	0	0	0	0	0	0	0	0	0	0	0	175	0	0	0	0	175
6 SELWAY-BITTERROOT WILDERNESS	0	0	20	0	0	4	21	182	46	4173	7513	2686	15	27	7	0	14674
20 ABSAROKA PRIMITIVE AREA	0	0	0	0	0	0	0	1007	0	0	0	0	0	0	0	0	1007
21 SPANISH PEAKS PRIMITIVE AREA	0	0	0	0	0	0	0	0	0	3	0	2	0	0	0	0	5
22 BEARTOOTH PRIMITIVE AREA	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
23 MISSIONS PRIMITIVE AREA	0	0	0	0	0	0	0	0	4	84	4	0	0	0	0	0	92
24 SALMON RIVER BREAKS PRIMITIVE	0	0	8	0	0	3	1	31	1770	53	73	922	56	1	10	35	2963
CATEGORY SUBTOTAL	0	0	32	37	0	9	32	1210	1930	5260	7872	4081	75	41	19	36	20634
50 WEST BIG HOLE (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51 ITALIAN PEAK (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53 BARB MOUNTIAN (NSA)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
54 MAURICE MOUNTIAN (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55 LAKE PLATEAU (NSA)	0	0	0	0	0	0	0	0	0	31	0	2	0	0	0	0	33
56 FISHTAIL PLATEAU (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 SAUDLE BACK MOUNTIAN (NSA)	0	0	0	0	0	0	0	180	0	0	0	0	0	0	0	0	180
58 HELL ROARING RED LODGE CREEK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61 FLINT RANGE (NSA)	0	0	0	0	0	0	0	52	0	0	0	40	0	171	0	0	283
63 MIDDLE FORK CONTINENTAL DIVID	0	0	0	0	0	1	0	0	6	2	2	4	0	0	0	0	15
64 SWAN HUNKER (NSA)	0	0	0	0	0	0	0	0	0	0	75	0	0	8	0	0	83
65 TOCHUCK (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66 THOMPSON SETON (NSA)	0	0	0	0	0	0	0	0	0	1	1004	0	0	0	0	0	1005
67 MILGARD (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68 HYALITE (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	20
69 NORTH ABSAROKA (NSA)	0	0	0	0	0	80	0	0	2	0	0	2	100	0	0	0	184
70 LION HEAD (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71 HELL ROARING BUFFALO FORK(NSA	0	0	0	0	0	26	0	0	0	4	0	0	0	0	0	0	30
72 ABUNDANCE WOLVERINE LOST CREE	0	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0	90
74 ROCK ISLAND (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76 SILVER KING FALLS CREEK (NSA)	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
77 ARRASTRA STONEWALL (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78 GATES OF THE MOUNTIANS (NSA)	0	0	0	0	0	0	4	0	4	0	4	0	8	0	0	0	20
79 ROCK MOUNTIAN FACE CONTINENTA	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
80 RENSHAW MOUNTIAN (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81 DEEP CREEK (NSA)	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	40
82 SWAN MOUTURE WEST SIDE (NSA)	0	0	0	0	0	0	0	0	16	2	34	4	2	0	0	0	58
83 HOODOO (NSA)	0	0	0	0	0	0	3	3	7	0	52	203	20	0	0	0	288
84 SCOTCHMAN PEAK (NSA)	0	0	0	0	0	0	0	0	0	0	33	0	0	13	0	0	46
85 LITTLE CLEARWATER RIVER (NSA)	0	0	0	0	0	0	0	0	0	0	39	1	88	0	0	0	128
86 HELLS HALF ACRE (NSA)	0	0	3	0	0	0	0	0	4	0	16	11	0	4	0	0	38
87 UPPER BANGAMIN (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88 MIDDLE BANGAMIN (NSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89 UPPER MALLARD CREEK	0	0	0	0	0	0	0	1	0	0	284	1	0	0	0	0	286
90 HELLS CANYON SEVEN DEVILS (NS	0	0	0	5	0	0	0	23	1	495	30	2	0	0	0	0	556
91 SALMO-PRIEST (NSA)	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	5
CATEGORY SUBTOTAL	0	0	3	5	0	107	7	260	40	538	1577	334	218	306	0	0	3395
GRAND TOTAL	70	135	349	139	511	770	2849	39767	14033	46441	49625	24831	57700	1122	309	90	238741

within the season than on non-wilderness lands. On the Selway-Bitterroot, for instance, 98% of the area burned has been in the month of August, as compared to 50% for the region as a whole. The two large fires that have occurred in the Salmon River Breaks occurred in late July and late August.

Further insight to burning environment on classified areas can be gained by inspection of Tables VI-10 and VI-11, which show the distribution of fire occurrence and area burned by fire danger rating adjective class. Two hundred and twenty-four classified area fires and 1625 non-classified area fires were excluded from this analysis because of improper coding on the individual fire reports. Fire danger rating adjective classes were assigned on the basis of suggestions by W. C. Fischer[1/] for converting the Model 6, Model 8 and NFDRS spread phase to a common adjective system. Fire danger ratings, especially for fires in remote wilderness areas, must be viewed as approximate at best. Nonetheless, as we showed earlier, the adjective classes correlate well with final fire size.

The Fitz Creek fire, a management fire, accounted for 39.4% of the total area burned in Region One by 141 fires during low fire danger during the entire 24-year period. Moreover, the Snake Creek fire, which started as a result of the Fitz Creek fire, accounted for 10.3% of the total area burned under moderate fire danger by 218 fires. The implications are that fire control efforts have probably resulted in a substantial reduction in area burned during periods of low and moderate fire danger in the Region and that the majority of fires will occur at a higher fire danger than either of these fires. Approximately 78% of the fires in the Selway-Bitterroot Wilderness have occurred at a higher fire danger than during the Fitz Creek fire.

1/ Fischer, W. C., "Suggested Adjective Ratings for Interpreting Fire Danger Ratings from Model 5, 6, 8 and NDFRS, Spread Phase Meters." Northern Forest Fire Laboratory, 8/5/74, unpublished.

TABLE VI-Io.
FIRE OCCURRENCE BY FIRE DANGER, CLASSIFIED AREA, REGION I, 1950-1973
EACH ARGUMENT REPRESENTS A 24-YEAR TOTAL

AREA CODE NUMBER AND NAME	LOW	MOD	HIGH	VERY	EXTR	TOTAL
10 NON-WILDERNESS	4248	6240	4908	2230	272	17898
CATEGORY SUBTOTAL	4248	6240	4908	2230	272	17898
1 ANACONDA PINTLAR WILDERNESS A	14	12	17	19	2	64
2 BOB MARSHALL WILDERNESS AREA	49	85	73	28	3	238
3 CABINET WILDERNESS AREA	4	20	25	6	0	55
4 GATES OF THE MOUNTIANS WILDER	2	8	8	8	1	27
5 SCAPEGOAT WILDERNESS AREA	10	15	13	6	0	44
6 SELWAY BITTERROOT WILDERNESS	320	462	427	189	10	1408
20 ABSAROKA PRIMITIVE AREA	1	2	4	0	0	7
21 SPANISH PEAKS PRIMITIVE AREA	2	2	2	1	1	8
22 BEARTOOTH PRIMITIVE AREA	1	0	5	0	1	7
23 MISSIONS PRIMITIVE AREA	6	17	14	6	0	43
24 SALMON RIVER BREAKS PRIMITIVE	39	67	69	53	5	233
CATEGORY SUBTOTAL	448	690	657	316	23	2134
50 WEST BIG HOLE (NSA)	1	3	0	0	0	4
51 ITALIAN PEAK (NSA)	0	0	0	0	0	0
53 BARB MOUNTIAN (NSA)	0	3	3	4	0	10
54 MAURICE MOUNTIAN (NSA)	1	0	0	0	0	1
55 LAKE PLATEAU (NSA)	0	1	0	2	0	3
56 FISHTAIL PLATEAU (NSA)	0	1	1	0	0	2
57 SADDLE BACK MOUNTIAN (NSA)	0	0	2	0	0	2
58 HELL ROARING RED LODGE CREEK	0	2	0	0	0	2
61 FLINT RANGE (NSA)	0	2	3	1	0	6
63 MIDDLE FORK CONTINENTAL DIVID	23	22	22	9	0	76
64 SWAN BUNKER (NSA)	6	8	5	2	0	21
65 TUCHUCK (NSA)	2	3	0	1	0	6
66 THOMPSON SETON (NSA)	1	2	2	3	2	10
67 HILGARD (NSA)	2	2	0	0	0	4
68 HYALITE (NDA)	0	0	0	1	0	1
69 NORTH ABSAROKA (NSA)	0	10	7	5	0	22
70 LION HEAD (NSA)	0	0	0	0	0	0
71 HELL ROARING BUFFALO FORK(NSA	0	1	1	1	1	4
72 ABUNDANCE WOLVERINE LOST CREE	1	3	2	0	0	6
74 ROCK ISLAND (NSA)	0	0	0	0	1	1
76 SILVER KING FALLS CREEK (NSA)	0	3	2	1	0	6
77 ARRASTRA STONEWALL (NSA)	0	6	3	1	0	10
78 GATES OF THE MOUNTIANS (NSA)	3	4	6	6	1	20
79 ROCK MOUNTIAN FACE CONTINENTA	0	1	0	2	0	3
80 RENSHAW MOUNTIAN (NSA)	0	2	1	2	0	5
81 DEEP CREEK (NSA)	0	0	0	1	0	1
82 SWAN MONTURE WEST SIDE (NSA)	13	23	18	12	0	66
83 HOODOO (NSA)	11	30	22	10	0	73
84 SCOTCHMAN PEAK (NSA)	0	11	4	1	0	16
85 LITTLE CLEARWATER RIVER (NSA)	31	15	15	14	0	75
86 HELLS HALF ACRE (NSA)	33	26	22	14	0	95
87 UPPER BARGAMIN (NSA)	5	7	7	0	0	19
88 MIDDLE BARGAMIN (NSA)	1	4	3	0	0	8
89 UPPER MALLARD CREEK	1	3	4	0	0	8
90 HELLS CANYON SEVEN DEVILS (NS	2	6	12	8	1	29
91 SALMO-PRIEST (NSA)	4	14	9	1	0	28
CATEGORY SUBTOTAL	141	218	176	102	6	643
GRAND TOTAL	4837	7148	5741	2648	301	20675

TABLE XI-11.
AREA BURNED BY FIRE DANGER, CLASSIFIED AREA, REGION I, 1950-1973
EACH ARGUMENT REPRESENTS A 24-YEAR TOTAL

AREA CODE NUMBER AND NAME	LOW	MOD	HIGH	VERY	EXTR	TOTAL
10 NON-WILDERNESS	1491	13254	45322	141618	11267	212952
CATEGORY SUBTOTAL	1491	13254	45322	141618	11267	212952
1 ANACONDA PINTLAR WILDERNESS A	7	3	1	8	0	19
2 BOB MARSHALL WILDERNESS AREA	1	25	396	99	270	791
3 CABINET WILDERNESS AREA	0	680	7	51	0	738
4 GATES OF THE MOUNTIANS WILDER	0	5	22	88	0	115
5 SCAPEGOAT WILDERNESS AREA	2	2	171	0	0	175
6 SELWAY BITTERROOT WILDERNESS	1401[1]	1886[2]	9928	1381	29	14625
20 ABSAROKA PRIMITIVE AREA	0	0	1007	0	0	1007
21 SPANISH PEAKS PRIMITIVE AREA	0	2	0	3	0	5
22 BEARTOOTH PRIMITIVE AREA	0	0	0	0	4	4
23 MISSIONS PRIMITIVE AREA	84	0	2	6	0	92
24 SALMON RIVER BREAKS PRIMITIVE	9	832	136	1946	6	2929
CATEGORY SUBTOTAL	1504[1]	3435[2]	11670	3582	309	20050
50 WEST BIG HOLE (NSA)	0	0	0	0	0	0
51 ITALIAN PEAK (NSA)	0	0	0	0	0	0
53 BARB MOUNTIAN (NSA)	0	0	0	1	0	1
54 MAURICE MOUNTIAN (NSA)	0	0	0	0	0	0
55 LAKE PLATEAU (NSA)	0	0	0	33	0	33
56 FISHTAIL PLATEAU (NSA)	0	0	0	0	0	0
57 SADDLE BACK MOUNTIAN (NSA)	0	0	180	0	0	180
58 HELL ROARING RED LODGE CREEK	0	0	0	0	0	0
61 FLINT RANGE (NSA)	0	0	112	0	0	112
63 MIDDLE FORK CONTINENTAL DIVID	1	0	10	4	0	15
64 SWAN BUNKER (NSA)	0	75	8	0	0	83
65 TUCHUCK (NSA)	0	0	0	0	0	0
66 THOMPSON SETON (NSA)	0	1004	0	0	1	1005
67 HILGARD (NSA)	0	0	0	0	0	0
68 HYALITE (NDA)	0	0	0	20	0	20
69 NORTH ABSAROKA (NSA)	0	0	2	82	0	84
70 LION HEAD (NSA)	0	0	0	0	0	0
71 HELL ROARING BUFFALO FORK(NSA	0	4	26	0	0	30
72 ABUNDANCE WOLVERINE LOST CREE	0	90	0	0	0	90
74 ROCK ISLAND (NSA)	0	0	0	0	0	0
76 SILVER KING FALLS CREEK (NSA)	0	0	3	0	0	3
77 ARRASTRA STONEWALL (NSA)	0	0	0	0	0	0
78 GATES OF THE MOUNTIANS (NSA)	0	3	4	5	0	12
79 ROCK MOUNTIAN FACE CONTINENTA	0	0	0	3	0	3
80 RENSHAW MOUNTIAN (NSA)	0	0	0	0	0	0
81 DEEP CREEK (NSA)	0	0	0	40	0	40
82 SWAN MONTURE WEST SIDE (NSA)	0	1	6	0	0	7
83 HOODOO (NSA)	0	10	267	11	0	288
84 SCOTCHMAN PEAK (NSA)	0	46	0	0	0	46
85 LITTLE CLEARWATER RIVER (NSA)	37	3	1	87	0	128
86 HELLS HALF ACRE (NSA)	14	12	1	6	0	33
87 UPPER BARGAMIN (NSA)	0	0	0	0	0	0
88 MIDDLE BARGAMIN (NSA)	0	0	0	0	0	0
89 UPPER MALLARD CREEK	0	1	3	0	0	4
90 HELLS CANYON SEVEN DEVILS (NS	0	5	32	504	0	541
91 SALMO-PRIEST (NSA)	0	5	0	0	0	5
CATEGORY SUBTOTAL	52	1259	655	796	1	2763
GRAND TOTAL	3047	16268	57647	145996	11577	234535

[1] includes 1200 acre Fritz Creek fire, a prescribed wildfire
[2] " 1680 acre Snake Creek fire

Fire occurrence has been heavily weighted toward low fire danger days in the Little Clearwater Area and Hell's Half Acre New Study Area, and weighted toward very high fire danger in the Gates of the Mountains and Anaconda-Pintlar Wilderness Areas.

The average fire size in each of the three land use classes for each level of fire danger is shown in Table VI-12. For the purposes of this table only, the Snake Creek and Fitz Creek fires are ignored. It is interesting to note that, although a greater proportion of fires exceed 10 acres on classified lands than on non-classified lands (Table VI-5), the average fire size on those days is much smaller. This reinforces our earlier conclusion that the steeper topography and remoteness of classified lands encourages fires of moderate size, but discontinuities in topography and fuels discourages very large fires.

The distribution of fire occurrence and area burned by general cover types for each classified area is shown in Tables VI-13 and VI-14. This tabulation does not recognize that a fire, expecially a large fire in wilderness, is likely to burn in two or more cover types. The cover types shown are generalizations of the cover types coded on the individual fire reports, which were more definitive with respect to mixtures of species and size classes, but were not consistent between decades. The last general cover type, designated "D-B-G" in the tables that follow, is a miscellaneous grouping of hardwoods, brush, and grassland types.

Fires in wilderness have burned in all cover types, but substantial acreages have burned only in the subalpine, Engelmann spruce, and ponderosa pine types since 1950. The Selway-Bitterroot is the only classified area that has had fires in all cover types in that period, with the plurality of fires and the majority of area burned in the subalpine type.

Table VI-12. Average Fire Size (Acres) by Fire Danger Rating Adjective Class, Classified Versus Non-Classified Areas, Region 1, 1950-1973, Based on 20,673 Fires.

Land Use Category	Fire Danger Rating				
	Low	Moderate	High	Very High	Extreme
Non-Wilderness[1/]	0.35	2.12	9.23	63.51	41.42
Wilderness & Primitive[2/]	0.68	2.55	17.76	11.34	130.83
Selway-Bitterroot[2/]	0.63	0.60	23.25	7.31	2.90
Bob Marshall	0.02	0.29	23.29	3.54	90.00
New Study Areas	0.37	5.78	3.72	7.80	0.17
All Lands	0.38	2.04	10.04	55.13	38.46

1/ Excludes non-forest acres during the period 1950-1959.

2/ Excludes Fitz Creek and Snake Creek fires, 1973.

TABLE VI -13.
FIRE OCCURRENCE BY COVER TYPE, CLASSIFIED AREAS, REGION I, 1950-1973
EACH ARGUMENT REPRESENTS A 24-YEAR TOTAL

AREA CODE NUMBER AND NAME	DOUG F-LAR	G-FIR	PPINE	SUBAL	WPINE	LPOLE	ENGLE	CD-HL	D-B-G	TOTAL
10 NON-WILDERNESS	3345 1270	2320	4709	1300	900	2096	887	1170	1520	19523
CATEGORY SUBTOTAL	3345 1270	2320	4709	1300	900	2096	887	1170	1520	19523
1 ANACONDA PINTLAR WILDERNESS A	9 0	0	1	32	1	18	3	0	1	65
2 BOB MARSHALL WILDERNESS AREA	40 11	8	9	75	6	49	30	0	11	239
3 CABINET WILDERNESS AREA	7 1	6	2	19	3	3	9	0	13	63
4 GATES OF THE MOUNTIANS WILDER	4 0	0	19	0	0	2	1	1	2	29
5 SCAPEGOAT WILDERNESS AREA	10 0	1	1	18	0	10	5	0	0	45
6 SELWAY BITTERROOT WILDERNESS	249 21	97	274	335	7	226	115	15	207	1546
20 ABSAROKA PRIMITIVE AREA	1 0	0	0	1	0	2	3	0	0	7
21 SPANISH PEAKS PRIMITIVE AREA	2 0	0	0	2	0	5	0	0	0	9
22 BEARTOOTH PRIMITIVE AREA	1 0	0	0	3	0	3	1	0	0	8
23 MISSIONS PRIMITIVE AREA	3 2	2	0	25	0	4	5	0	2	43
24 SALMON RIVER BREAKS PRIMITIVE	42 0	9	96	57	1	31	14	0	6	258
CATEGORY SUBTOTAL	368 35	123	404	567	18	353	186	16	242	2312
50 WEST BIG HOLE (NSA)	0 0	0	0	3	0	1	0	0	0	4
51 ITALIAN PEAK (NSA)	1 0	0	0	0	0	0	0	0	0	1
53 BARO MOUNTIAN (NSA)	3 0	0	0	3	0	3	1	0	0	10
54 MAURICE MOUNTIAN (NSA)	1 0	0	0	0	0	2	0	0	0	3
55 LAKE PLATEAU (NSA)	0 0	0	0	1	0	1	1	0	0	3
56 FISHTAIL PLATEAU (NSA)	0 0	0	0	2	0	0	0	0	0	2
57 SADDLE BACK MOUNTIAN (NSA)	0 0	0	0	1	0	1	0	0	0	2
58 HELL ROARING RED LODGE CREEK	0 0	0	0	1	0	1	0	0	0	2
61 FLINT RANGE (NSA)	0 0	0	0	3	0	3	1	0	0	7
63 MIDDLE FORK CONTINENTAL DIVID	4 6	4	0	33	1	3	5	0	21	77
64 SWAN BURGER (NSA)	2 1	2	0	13	0	1	3	0	0	22
65 TOBACCO (NSA)	1 0	0	0	4	0	1	1	0	0	7
66 THOMPSON SETON (NSA)	0 0	2	0	3	0	0	1	0	4	10
67 HILGARD (NSA)	3 0	0	0	2	0	0	0	0	3	8
68 HYALITE (NSA)	0 0	0	0	1	0	0	0	0	0	1
69 NORTH ABSAROKA (NSA)	10 0	0	0	7	0	7	1	0	0	25
70 LION HEAD (NSA)	1 0	0	0	0	0	0	0	0	0	1
71 HELL ROARING BUFFALO FORK(NSA	2 0	0	0	2	0	0	0	0	0	4
72 ABUNDANCE WOLVERINE LOST CREE	1 0	0	0	3	0	1	1	0	0	6
74 ROCK ISLAND (NSA)	0 0	0	0	0	0	1	0	0	0	1
76 SILVER KING FALLS CREEK (NSA)	1 0	0	0	3	1	1	0	0	0	6
77 ARRASTRA STONEWALL (NSA)	1 0	0	0	8	0	1	0	0	0	10
78 GATES OF THE MOUNTIANS (NSA)	4 0	0	12	0	0	3	0	0	2	21
79 ROCK MOUNTIAN FACE CONTINENTA	1 0	0	0	2	0	1	0	0	0	4
80 RENSHAW MOUNTIAN (NSA)	5 0	0	0	1	0	0	0	0	0	6
81 DEEP CREEK (NSA)	1 0	0	0	0	0	0	0	0	0	1
82 SWAN MONTURE WEST SIDE (NSA)	17 4	2	3	29	0	12	7	0	2	76
83 HOODOO (NSA)	5 5	3	1	19	1	20	14	0	6	74
84 SCOTCHMAN PEAK (NSA)	2 1	2	1	7	1	0	1	1	0	16
85 LITTLE CLEARWATER RIVER (NSA)	27 0	1	13	13	0	15	2	0	4	75
86 HELLS HALF ACRE (NSA)	43 0	0	22	13	0	20	2	0	0	100
87 UPPER BARGAMIN (NSA)	7 0	4	2	6	0	0	2	0	0	21
88 MIDDLE BARGAMIN (NSA)	6 0	0	1	1	0	2	1	0	0	11
89 UPPER MALLARD CREEK	1 0	0	2	2	0	4	1	0	0	10
90 HELLS CANYON SEVEN DEVILS (NS	9 0	4	11	7	0	2	0	0	0	33
91 SALMO-PRIEST (NSA)	2 2	2	4	7	0	0	3	7	2	29
CATEGORY SUBTOTAL	161 19	26	72	200	4	107	48	8	44	687
GRAND TOTAL	3874 1324	2469	5185	2067	928	2556	1121	1194	1806	22524

TABLE VI -14.
AREA BURNED BY COVER TYPE, CLASSIFIED AREAS, REGION I, 1950-1973
EACH ARGUMENT REPRESENTS A 24-YEAR TOTAL

AREA CODE NUMBER AND NAME	DOUG F-LAR	G-FIR	PPINE	SUBAL	WPINE	LPOLE	ENGLE	CO-HL	D-B-G	TOTAL
10 NON-WILDERNESS	8131 1225	725	50052	61480	1402	43961	25731	310	21796	214804
CATEGORY SUBTOTAL	8131 1225	725	50052	61480	1402	43961	25731	310	21796	214804
1 ANACONDA PINTLAR WILDERNESS A	0 0	0	0	12	1	6	0	0	0	19
2 BOB MARSHALL WILDERNESS AREA	7 0	3	0	55	270	6	442	0	8	791
3 CABINET WILDERNESS AREA	8 0	4	3	1	0	0	675	0	61	752
4 GATES OF THE MOUNTIANS WILDER	11 0	0	56	0	0	2	0	0	83	152
5 SCAPEGOAT WILDERNESS AREA	0 0	0	1	172	0	0	2	0	0	175
6 SELWAY BITTERROOT WILDERNESS	151 2	15	3765	9865	0	153	673	1	49	14674
20 ABSAROKA PRIMITIVE AREA	0 0	0	0	0	0	0	1007	0	0	1007
21 SPANISH PEAKS PRIMITIVE AREA	0 0	0	0	2	0	3	0	0	0	5
22 BEARTOOTH PRIMITIVE AREA	0 0	0	0	0	0	0	4	0	0	4
23 MISSIONS PRIMITIVE AREA	0 0	0	0	5	0	82	5	0	0	92
24 SALMON RIVER BREAKS PRIMITIVE	24 0	0	2751	28	0	105	55	0	0	2963
CATEGORY SUBTOTAL	201 2	22	6576	10140	271	357	2863	1	201	20634
50 WEST BIG HOLE (NSA)	0 0	0	0	0	0	0	0	0	0	0
51 ITALIAN PEAK (NSA)	0 0	0	0	0	0	0	0	0	0	0
53 BARB MOUNTIAN (NSA)	0 0	0	0	0	0	1	0	0	0	1
54 MAURICE MOUNTIAN (NSA)	0 0	0	0	0	0	0	0	0	0	0
55 LAKE PLATEAU (NSA)	0 0	0	0	0	0	31	2	0	0	33
56 FISHTAIL PLATEAU (NSA)	0 0	0	0	0	0	0	0	0	0	0
57 SADDLE SACK MOUNTIAN (NSA)	0 0	0	0	0	0	180	0	0	0	180
58 HELL ROARING RED LODGE CREEK	0 0	0	0	0	0	0	0	0	0	0
61 FLINT RANGE (NSA)	0 0	0	0	60	0	52	171	0	0	283
63 MIDDLE FORK CONTINENTAL DIVID	0 0	0	0	8	0	0	0	0	7	15
64 SWAN BUNKER (NSA)	0 0	0	0	75	0	8	0	0	0	83
65 TUCHUCK (NSA)	0 0	0	0	0	0	0	0	0	0	0
66 THOMPSON SETON (NSA)	0 0	0	0	1	0	0	1004	0	0	1005
67 HILGARD (NSA)	0 0	0	0	0	0	0	0	0	0	0
68 HYALITE (NSA)	0 0	0	0	20	0	0	0	0	0	20
69 NORTH ABSAROKA (NSA)	80 0	0	0	2	0	102	0	0	0	184
70 LION HEAD (NSA)	0 0	0	0	0	0	0	0	0	0	0
71 HELL ROARING BUFFALO FORK(NSA	0 0	0	0	30	0	0	0	0	0	30
72 ABUNDANCE WOLVERINE LOST CREE	0 0	0	0	90	0	0	0	0	0	90
74 ROCK ISLAND (NSA)	0 0	0	0	0	0	0	0	0	0	0
76 SILVER KING FALLS CREEK (NSA)	0 0	0	0	0	3	0	0	0	0	3
77 ARRASTRA STONEWALL (NSA)	0 0	0	0	0	0	0	0	0	0	0
78 GATES OF THE MOUNTIANS (NSA)	1 0	0	16	0	0	0	0	0	3	20
79 ROCK MOUNTIAN FACE CONTINENTA	0 0	0	0	3	0	0	0	0	0	3
80 RENSHAW MOUNTIAN (NSA)	0 0	0	0	0	0	0	0	0	0	0
81 DEER CREEK (NSA)	40 0	0	0	0	0	0	0	0	0	40
82 SWAN MONTURE WEST SIDE (NSA)	0 0	0	2	31	0	7	16	0	2	58
83 HOODOO (NSA)	0 5	8	0	223	0	50	2	0	0	288
84 SCOTCHMAN PEAK (NSA)	13 0	0	0	33	0	0	0	0	0	46
85 LITTLE CLEARWATER RIVER (NSA)	1 0	0	68	47	0	12	0	0	0	128
86 HELLS HALF ACRE (NSA)	10 0	0	12	4	0	12	0	0	0	38
87 UPPER BARGAMIN (NSA)	0 0	0	0	0	0	0	0	0	0	0
88 MIDDLE BARGAMIN (NSA)	0 0	0	0	0	0	0	0	0	0	0
89 UPPER MALLARD CREEK	282 0	0	2	1	0	1	0	0	0	286
90 HELLS CANYON SEVEN DEVILS (NS	23 0	1	531	1	0	0	0	0	0	556
91 SALMO-PRIEST (NSA)	0 4	0	0	0	0	0	0	1	0	5
CATEGORY SUBTOTAL	450 9	9	631	629	3	456	1195	1	12	3395
GRAND TOTAL	8782 1236	756	57250	72249	1676	44774	29789	312	22009	238833

The same can be said of Engelmann spruce type in the Bob Marshall Wilderness and ponderosa pine in the Salmon River Breaks Primitive Area.

The average size of fires has been the largest in subalpine fir and Engelmann spruce cover types in classified as well as non-classified areas. The average size by cover type is presented in Table VI-15. Fires in ponderosa pine, which have occurred in virtually every classified area, have also had an average size much larger than in other types. Fires in lodgepole pine and Douglas-fir have been much smaller in Wilderness areas than in the Region as a whole.

Some bias must be expected in the average size of fires reported here, as a result of the singular coding of one cover type on the fire reports. For example, a wilderness fire in ponderosa pine is quite likely to spread into Douglas-fir or lodgepole pine, while the reverse is much less likely. In that case, the total acreage of the larger fire would be coded as area burned in ponderosa pine.

Table VI-15. Average Fire Size (Acres) by General Cover Type, Classified Versus Non-Classified Areas, Region 1, 1950-1973, Based on 22524 Fires.

Land Use	Cover Type: Doug F-Lar G -fir	P pine	Subal	W pine	L pole	Engel.	Cd-Hen	D-B-G
Non-Wilderness	2.43	0.96	0.31	10.63	47.29	1.55	20.97	29.01	0.26	14.34
Wilderness	0.55	0.06	0.18	16.28	17.88	15.06	1.01	15.39	0.06	0.83
Selway-Bit.	0.61	0.10	0.15	13.74	29.45	0	0.68	5.85	0.07	0.24
Bob Marshall	0.18	0	0.38	0	0.73	45.00	0.12	14.73	0	0.73
New Study Areas	2.80	0.47	0.35	8.76	3.15	0.75	4.26	24.90	0.13	0.27
All Lands	2.27	0.93	0.31	11.04	34.95	1.81	17.52	26.57	0.26	12.19

VI-2. Potential Wilderness Fire Load

Our data base consists almost entirely of fires which have received suppression action. Until considerable experience is gained with free-burning prescribed natural fires, we can make no prediction of the daily fire load, or the expected annual burn in a wilderness area. The purpose of this discussion is to propose the structure of a predictive model that will assist in developing wilderness fire management strategies.

The predicted impact of allowing a single fire to burn without suppression, or of allowing a finite number of fires to burn in a limited area can probably best be gained through simulation of fire spread using specific data describing the actual fuel, topography, and predicted weather. The data bank we provide herewith would be of little use in such an effort. Questions on a larger scale, however, such as the predicted mean and extreme fire loads that can be expected in a large wilderness fire management unit can be answered in part with these data.

Important considerations in the management of natural fires include:

1) The number of Wilderness fires that may be added in one day to the existing fire load.

2) The number of fires on a given day that can be expected to be concurrently active in a wilderness fire management unit.

3) The probability distribution of the annual area burned that can be expected in a fire management unit.

Only the first consideration, which must be weighed in relation to the available suppression forces, can be made with the available data. The daily fire occurrence record for the region, a forest, or a classified area can be readily read from the data bank transmitted herewith, and in some cases from the results presented in earlier chapters.

The prediction of the number of concurrently active fires in a fire management unit requires knowledge in addition to the probability distribution of fire occurrence. Specifically, we need to know how long a fire is likely to persist if no suppression action is taken, given some knowledge of the fuel or cover type and the probability of significant precipitation. Limited experience with wilderness fire management programs has demonstrated that natural fires frequently smoulder for several months before a fire run is made. A combination of this data base, along with a frequency distribution accumulated by observing the persistence of prescribed natural fires in the next several years, would allow us to predict the range of natural fire loads that could be expected in an area. We encourage the systematic collection of data that describes the persistence of fires as affected by cover type, time of year, and precipitation amount.

The prediction of the annual area that can be expected to burn in a fire management unit also requires additional experience. Specifically, we need to know what the size of a fire is likely to be, given the prevailing cover type and the burning index (or spread component) during the duration of each prescribed natural fire. A combination of this data base which provides the means to predict fire occurrence, along with the probability distribution of fire occurrence, in addition to a probability distribution of the area or perimeter growth that can be expected on a day of a given fire danger, would allow the reasonable prediction of area burned.

We therefore propose that a model to predict wilderness fire loads utilize the technique of Monte Carlo simulation, with the inputs stratified by cover type and fire danger rating. The inputs to the model

would include frequency distributions of the following accumulations of data:

1) Daily fire occurrence, from fire reports.

2) Persistence of observed fires.

3) Daily growth of observed fires.

The daily or seasonal natural fire load could than be simulated by random selections from the three data sets, with iterative dynamic solutions to obtain the distribution of predicted fire loads.

We strongly encourage a systematic collection of data, in a format common to all agencies, that would include the following minimum reporting for each natural fire:

1) A standard 5100-29 individual fire report, with an additional coding category to indicate the degree of suppression.

2) A daily record of fire size and perimeter

3) A daily record of fire danger rating

4) A daily record of the physical environment, i.e. the cover type, slope class, topography, special weather feature, and precipitation amount.

The record of each fire could easily be added to the individual fire report, and archived with it for future analysis. The simplest scheme, and the most useful, would be the completion of a new individual fire report for each day. A model to predict wilderness fire loads, essential to planning management strategies, can be realized only with the support of such a scheme of systematic fire reporting.

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APPENDIX

APPENDIX	CONTENTS
A-1 thru A-8	Examples of output contained on the data bank
B-1 thru B-46	Annual fire load by classified area

**********SUMMARY FOR JULY 2, 1946----- 31 FIRES, 0 ACRES BURNED**********

FOREST NAME	TOTAL	NUMBER OF FIRES A	B	C	D	E	F	G	ACRES BURNED
CABINET	4	4	0	0	0	0	0	0	0
CLEARWATER	16	16	0	0	0	0	0	0	0
HELENA	1	1	0	0	0	0	0	0	0
KOOTENAI	1	1	0	0	0	0	0	0	0
LOLO	1	1	0	0	0	0	0	0	0
NEZPERCE	5	5	0	0	0	0	0	0	0
ST. JOE	3	3	0	0	0	0	0	0	0

**********SUMMARY FOR JULY 13, 1946----- 17 FIRES, 0 ACRES BURNED**********

FOREST NAME	TOTAL	NUMBER OF FIRES A	B	C	D	E	F	G	ACRES BURNED
BEAVERHEAD	1	1	0	0	0	0	0	0	0
COEUR DALENE	1	1	0	0	0	0	0	0	0
COLVILLE	1	1	0	0	0	0	0	0	0
DEERLODGE	1	1	0	0	0	0	0	0	0
HELENA	2	2	0	0	0	0	0	0	0
KANIKSU	4	4	0	0	0	0	0	0	0
KOOTENAI	6	4	2	0	0	0	0	0	0
LEWIS AND CLARK	1	1	0	0	0	0	0	0	0

**********SUMMARY FOR JULY 29, 1946-----154 FIRES, 174 ACRES BURNED**********

FOREST NAME	TOTAL	NUMBER OF FIRES A	B	C	D	E	F	G	ACRES BURNED
BITTERROOT	12	10	2	0	0	0	0	0	0
CLEARWATER	30	28	2	0	0	0	0	0	5
CUSTER	1	0	0	1	0	0	0	0	14
DEERLODGE	1	1	0	0	0	0	0	0	0
FLATHEAD	6	3	2	1	0	0	0	0	104
HELENA	1	1	0	0	0	0	0	0	0
KANIKSU	23	23	0	0	0	0	0	0	0
KOOTENAI	15	12	3	0	0	0	0	0	1
LEWIS AND CLARK	2	2	0	0	0	0	0	0	0
LOLO	38	27	10	1	0	0	0	0	48
NEZPERCE	25	22	3	0	0	0	0	0	2

Appendix Table A-1. Abnormal Fireload

REGIONAL ANALYSIS OF FIRELOAD
YEAR= 1950 MONTH= MAY

DATE	WILDERNESS AND PRIMITIVE A	B	C	D	E	TOTAL ACRES		WILDERNESS STUDY A	B	C	D	E	TOTAL ACRES		NON WILDERNESS A	B	C	D	E	TOTAL ACRES		FOREST#S TOTAL A	B	C	D	E	TOTAL ACRES	
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	15	0	0	0	1	0	1	15
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	15	0	0	0	1	0	1	15
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	15	0	0	0	1	0	1	15

REGIONAL ANALYSIS OF FIRELOAD
YEAR= 1950 MONTH= JUN

DATE	WILDERNESS AND PRIMITIVE A	B	C	D	E	TOTAL ACRES		WILDERNESS STUDY A	B	C	D	E	TOTAL ACRES		NON WILDERNESS A	B	C	D	E	TOTAL ACRES		FOREST#S TOTAL A	B	C	D	E	TOTAL ACRES	
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	10	0	10	0	0	0	0	10	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	13	0	13	0	0	0	0	13	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	5	0	0	0	0	5	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	3	0	0	0	0	3	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	4	0	0	0	0	4	0
16	1	0	0	0	0	1	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	5	0	0	0	0	5	0
17	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
18	1	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	4	0	0	0	0	4	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	3	0	0	0	0	3	0
SUB TOTAL	3	0	0	0	0	3	0	0	0	0	0	0	0	0	45	0	0	0	0	45	0	48	0	0	0	0	48	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	2	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	2	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	5	0	0	0	0	5	0
GRAND TOTAL	3	0	0	0	0	3	0	0	0	0	0	0	0	0	51	0	0	0	0	51	0	54	0	0	0	0	54	0

Appendix Table A-2. REGIONAL ANALYSIS OF FIRELOAD

Appendix Table A-3. Forest Analysis of Fireload.

ANALYSIS OF FIRELOAD BEAVERHEAD NATIONAL FOREST
YEAR= 1947 MONTH= JUL

DATE	WILDERNESS AND PRIMITIVE A	B	C	D	E	TOTAL	ACRES	WILDERNESS STUDY A	B	C	D	E	TOTAL	ACRES	NON WILDERNESS A	B	C	D	E	TOTAL	ACRES	FOREST#S TOTAL A	B	C	D	E	TOTAL	ACRES
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	2	0
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	2	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	2	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	4	0	1	0	0	0	1	4
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	5	4	4	1	0	0	0	5	4
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	3	0	0	0	0	3	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	16	0	2	0	0	0	2	16
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	2	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	170	0	0	0	1	0	1	170
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2	0	2	0	10	186	6	2	0	2	0	10	186
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	0	2	0	17	190	12	3	0	2	0	17	190

ANALYSIS OF FIRELOAD BEAVERHEAD NATIONAL FOREST
YEAR= 1947 MONTH= AUG

DATE	WILDERNESS AND PRIMITIVE A	B	C	D	E	TOTAL	ACRES	WILDERNESS STUDY A	B	C	D	E	TOTAL	ACRES	NON WILDERNESS A	B	C	D	E	TOTAL	ACRES	FOREST#S TOTAL A	B	C	D	E	TOTAL	ACRES
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	4	0	1	0	0	0	1	4
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	4	1	1	0	0	0	2	4
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	2	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	9	0	1	0	0	0	1	9
SUB TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	3	9	2	1	0	0	0	3	9
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	7	13	5	2	0	0	0	7	13

Appendix Table A-4. Fire Control.

CLEARWATER NATIONAL FOREST

DISCOVERY METHOD	NUMBER DISCOVERED	AVERAGE AREA DETECTED	AVERAGE ELAPSED TIME TO DISCOVERY
OTHER	8	0	.28
LOOKOUT, FS	210	0	.16
PATROLMAN	2	0	.37
OTHER FS	79	0	.25
COOPERATOR	2	0	.02
FS PERMITTEE	3	0	.29
AIR OBS. FS	12	0	.33

FIRST ATTACK BY DOZER

NO.	AVE. ATTACK AREA	AVE. ATTACK TIME	AVE. PER ATTACK	AVE. NO. MEN	AVE AREA CONTROLLED	AVE. PER INC
CHARACTOR OF FIRE SMOLDERING						
5	4	0.00	30	15	3	0
CHARACTOR OF FIRE CREEPING						
14	3	0.00	12	20	3	0
CHARACTOR OF FIRE RUNNING						
3	11	0.00	42	21	13	0
CHARACTOR OF FIRE SPOTTING						
5	2	0.00	21	24	4	0

FIRE DANGER LOW

SIZE CLASS	NO FIRES	AVE NO OF MEN	AVEMAN HRS	AVE AREA CONTROLLED
1	160	0	0	0
2	9	0	116	4

FIRE DANGER MODERATE

SIZE CLASS	NO FIRES	AVE NO OF MEN	AVEMAN HRS	AVE AREA CONTROLLED
1	63	0	0	0
2	7	0	4	2
3	1	0	0	30

FIRE DANGER HIGH

SIZE CLASS	NO FIRES	AVE NO OF MEN	AVEMAN HRS	AVE AREA CONTROLLED
1	44	0	0	0
2	7	0	9	2

FIRE DANGER VERY HIGH

SIZE CLASS	NO FIRES	AVE NO OF MEN	AVEMAN HRS	AVE AREA CONTROLLED
1	5	0	0	0
2	1	0	0	4

FIRE DANGER NOT CODED

SIZE CLASS	NO FIRES	AVE NO OF MEN	AVEMAN HRS	AVE AREA CONTROLLED
1	26	0	0	0
2	2	0	83	3

Appendix Table A-5. Summary of Large Fires

SUMMARY OF D AND LARGER FIRES FOR REGION ONE

FOR / WC IO LD UE / SIZE / SUPR	NO.	DATE OF FIRE START MO DY YR	DATE OF FIRE CONTROL MO DY YR	ORIG TIME	ELAPSED TIME TO DET.	ELAPSED TIME TO ATTK	ELAPSED TIME TO CNTL	AREA AT TIME OF DT	AREA AT TIME OF ATK	AREA AT TIME OF CONTRL	FAK	NO. MEN	FIRE DANGER ATTK	FIRE DANGER WRST	WIND VELOCITY ATTK	WIND VELOCITY WRST	TU IN M AQUE L.FN	C OF VY EP RE	FUEL TYPE OR	FUEL TYPE PY
2-0 4	17	7-27-47	7-28-47	0	30	14	57	1	17	170	1	60	3100	-0	15	4000	-0	10	22	23
2-0 4	18	7-29-47	7-29-47	0	32	85	2	10	99	245	1	60	-0	-0	0	3000	-0	9	22	22
2 0 4	43	9-11-53	9-29-53	0	7800	235	890	0	4	266	*	2	-0	-0	8	1000	179	8	22	12
2 0 5	11	9- 5-55	9- 8-55	13	20	45	184	5	30	364	*	3	5300	53	25	4000	74	10	41	3
2 0 4	18	8-12-57	8-22-57	3	5650	215	483	0	10	230	*	5	4900	51	15	3000	167	8	22	12
2 0 4	19	7-20-60	7-20-60	1	5	110	1	0	20	286	4	-0	6100	-0	-0	-0	130	94	21	10
2 0 4	8	7-16-61	7-16-61	2	1330	30	0	0	0	162	4	-0	5200	-0	-0	-0	96	63	22	60
2 0 6	14	8-14-64	8-14-64	2	1300	315	1	-0	40	1070	4	-0	3400	-0	-0	-0	177	93	43	50
2 0 4	15	8-20-73	8-20-73	16	10	10	8	-0	-0	153	4	-0	3400	34	8	8	8	95	31	31
3-0 7	108	8- 1-47	8- 1-47	0	14	99	21	0	99	5240	1	2	700	-0	3	2000	-0	29	22	23
3 6 4	89	8-17-56	8-25-56	20	4125	330	410	1	90	160	*	60	4100	41	12	1000	153	11	12	14
3 0 6	35	7-20-60	7-20-60	1	225	335	2	0	40	3050	4	-0	4000	-0	-0	-0	1450	63	43	70
3 0 5	36	7-21-60	7-21-60	1	5	30	0	0	20	355	4	-0	5700	-0	-0	-0	50	94	31	10
3 0 4	36	7-16-61	7-16-61	1	2420	310	0	0	15	290	4	-0	8400	-0	-0	-0	385	63	23	70
3 0 7	81	8- 4-61	8- 4-61	1	10	40	4	-0	-0	28002	4	-0	6100	-0	-0	-0	-0	63	23	70
3 0 5	58	8-17-61	8-17-61	1	5200	340	1	0	0	510	4	-0	3200	-0	-0	-0	450	91	23	60
3 0 4	163	8-28-61	8-28-61	1	40	400	1	0	2	100	8	-0	3000	-0	-0	-0	140	91	22	60
3 0 4	162	8-29-61	8-29-61	1	15	20	0	0	15	290	3	-0	2700	-0	-0	-0	130	34	31	10
324 6	23	7-20-62	7-20-62	1	9999	40	1	2	4	1765	8	-0	5100	-0	-0	-0	575	33	31	20
3 6 6	43	8-10-73	8-10-73	6	530	7215	-0	-0	-0	1200	4	-0	700	9	6	9	95	33	31	31
3 6 4	51	8-13-73	8-15-73	6	630	150	98	-0	-0	155	6	-0	900	11	9	9	247	91	22	22
3 0 6	58	8-15-73	8-17-73	17	15	15	136	-0	-0	1680	4	-0	1500	15	4	9	700	3	23	23
5 0 4	68	8-18-53	9- 2-53	16	0	2330	740	1	30	150	2	2	5600	56	4	2800	64	4	11	12
5 0 5	50	8- 1-59	8- 1-59	7	-0	-0	-0	-0	-0	0	*	-0	-0	-0	-0	-0	-0	-0	0	-0
5 0 6	59	8- 4-61	8- 4-61	2	35	1155	1	0	4	1108	4	-0	6400	-0	-0.	-0	657	73	22	60
5 0 6	56	8- 4-61	8- 4-61	1	-0	1410	5	0	30	3895	4	-0	6300	-0	-0	-0	357	73	33	60
5 6 6	50	8- 4-61	8- 4-61	1	225	105	5	2	10	2780	8	-0	4900	-0	-0	-0	700	91	14	60
5 0 5	113	8-24-61	8-24-61	1	-0	35	1	0	25	385	4	-0	4700	-0	-0	-0	600	53	22	50
5 0 4	41	8-12-67	8-12-67	0	655	415	1	0	0	144	7	-0	3200	-0	-0	-0	290	13	12	70
5 0 5	39	8-12-67	8-12-67	0	400	515	1	0	1	310	7	-0	3200	-0	-0	-0	331	62	22	20
5 0 4	44	8-20-67	8-20-67	1	5	45	1	0	3	127	4	-0	4800	-0	-0	-0	145	53	32	60
5 0 4	47	8-20-67	8-20-67	2	15	105	1	0	0	168	4	-0	1500	-0	-0	-0	210	53	21	80
5 6 5	45	8-20-67	8-20-67	1	45	1725	1	2	40	812	4	-0	5000	-0	-0	-0	366	91	22	50
6 0 4	107	8-22-61	8-22-61	0	426	5	0	0	0	163	1	-0	4200	-0	-0	-0	150	4	42	30
7 0 5	58	8-12-67	8-12-67	2	9999	30	1	0	1	490	4	-0	7400	-0	-0	-0	310	14	32	20
8-0 4	13	8- 5-46	8- 5-46	0	2	5	3	20	47	200	1	4	9500	-0	10	1000	-0	37	31	31
8-0 4	41	9-27-47	9-27-47	0	16	2	3	92	99	274	1	2	-0	-0	15	3000	-0	37	21	21
8-0 4	8	6-26-49	6-26-49	0	4	10	3	15	67	150	1	3	-0	-0	12	2000	-0	37	21	21
8-0 4	19	7- 1-49	7- 1-49	0	0	13	2	0	17	110	1	1	-0	-0	5	0	-0	37	11	11
8-0 6	27	8-12-49	8-12-49	0	5	10	40	1	15	4350	1	3	-0	-0	-0	-0	-0	20	21	21
8 0 5	22	7-30-54	8- 5-54	0	100	30	313	0	0	398	2	5	7600	76	3	4000	135	11	22	13
8 0 4	1	8-22-55	8-22-55	0	0	0	0	-0	-0	0	*	3	-0	-0	-0	-0	-0	-0	0	-0
8 0 4	3	6- 9-56	6- 9-56	-0	-0	-0	-0	-0	-0	0	*	5	-0	-0	-0	-0	-0	-0	0	-0
8 0 5	37	8- 4-56	8-13-56	22	1220	208	443	1	6	394	*	70	7000	70	10	3000	103	11	41	12
8 0 4	40	8- 5-56	8- 6-56	3	730	110	60	0	3	111	*	2	6800	68	11	3000	23	11	31	12
8 0 4	5	8-12-56	8-12-56	-0	-0	-0	-0	-0	-0	19	*	4	-0	-0	-0	-0	-0	-0	0	-0
8 0 4	1	5-29-58	5-29-58	-0	-0	-0	-0	-0	-0	0	*	-0	-0	-0	-0	-0	-0	-0	0	-0
8 0 5	28	8-26-59	9- 5-59	21	1030	215	494	0	2	349	2	2	6900	69	20	4000	156	11	21	14
8 0 4	15	7-23-60	7-23-60	1	142	53	1	10	80	140	4	-0	6200	-0	-0	-0	60	94	41	10
8 0 4	27	7-24-60	7-24-60	1	2505	40	0	6	100	131	4	-0	6300	-0	-0	-0	105	94	21	10
8 0 4	45	8- 2-60	8- 2-60	1	1532	53	0	4	25	240	4	-0	6600	-0	-0	-0	125	33	21	60
8 0 4	11	6-28-61	6-28-61	2	1257	118	0	1	3	232	4	-0	1700	-0	-0	-0	125	33	21	10
857 4	33	7-16-61	7-16-61	2	1225	405	1	0	10	180	4	-0	4400	-0	-0	-0	340	63	12	20
8 0 5	25	8-18-63	8-18-63	2	1500	30	0	5	20	427	4	-0	5000	-0	-0	-0	160	32	31	20
8 0 4	8	6-19-66	6-19-66	1	1655	115	0	3	5	163	4	-0	1700	-0	-0	-0	38	32	21	10
8 0 6	27	7- 7-66	7- 7-66	1	50	50	1	0	2	2086	4	-0	4300	-0	-0	-0	177	32	21	20
8 0 7	65	7-19-66	7-19-66	0	222	58	1	0	10	12832	4	-0	5800	-0	-0	-0	274	32	21	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	0	25	3283	4	-0	5800	-0	-0	-0	206	32	31	10

Appendix Table A-6. Percentage Distribution.

PERCENTAGE DISTRIBUTION OF NUMBER OF FIRES BY SIZE CLASS. EACH SMALL TABLE REPRESENTS A CATEGORY OF
10-DAY PER. REGION ONE INTERVAL 1970-1973 4365 RECS

SIZE MAY 1-10	EASTERN FORESTS AND GROUPS									WESTERN FORESTS AND GROUPS														
	BEA	CUS	GAL	SE	DEE	HEL	LEW	NE	EAST	BIT	CLE	NEZ	SW	CAB	LOL	FLA	KOO	NO	COE	COL	KAN	STJ	NW	WEST	REGION
1	0	50	0	50	100	0	0	75	67	0	0	100	100	0	67	0	0	67	0	0	100	0	100	75	71
2	0	50	0	50	0	100	0	25	33	0	0	0	0	0	33	0	0	33	0	0	0	0	0	25	29
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	2	0	2	3	1	0	4	6	0	0	1	1	0	6	0	0	6	0	0	1	0	1	8	14

SIZE MAY 11-20	EASTERN FORESTS AND GROUPS									WESTERN FORESTS AND GROUPS														
	BEA	CUS	GAL	SE	DEE	HEL	LEW	NE	EAST	BIT	CLE	NEZ	SW	CAB	LOL	FLA	KOO	NO	COE	COL	KAN	STJ	NW	WEST	REGION
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100	0	100	75	33
2	0	80	0	80	0	0	0	0	80	0	100	0	100	0	0	0	0	0	0	0	0	0	0	25	56
3	0	20	0	20	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	5	0	5	0	0	0	0	5	0	1	0	1	0	0	0	0	0	0	2	1	0	3	4	9

SIZE MAY 21-31	EASTERN FORESTS AND GROUPS									WESTERN FORESTS AND GROUPS														
	BEA	CUS	GAL	SE	DEE	HEL	LEW	NE	EAST	BIT	CLE	NEZ	SW	CAB	LOL	FLA	KOO	NO	COE	COL	KAN	STJ	NW	WEST	REGION
1	0	0	100	50	0	0	0	0	50	100	0	75	80	0	100	0	100	100	100	0	100	0	100	96	93
2	0	100	0	50	0	0	0	0	50	0	0	25	20	0	0	0	0	0	0	0	0	0	0	4	7
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	1	1	2	0	0	0	0	2	1	0	4	5	0	7	0	8	15	1	0	4	0	5	25	27

SIZE JUN 1-10	EASTERN FORESTS AND GROUPS									WESTERN FORESTS AND GROUPS														
	BEA	CUS	GAL	SE	DEE	HEL	LEW	NE	EAST	BIT	CLE	NEZ	SW	CAB	LOL	FLA	KOO	NO	COE	COL	KAN	STJ	NW	WEST	REGION
1	100	50	0	56	100	100	100	100	75	88	94	50	81	0	88	0	90	89	50	0	100	75	78	83	81
2	0	50	0	44	0	0	0	0	25	13	6	50	19	0	13	0	10	11	50	0	0	25	22	17	19
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	8	0	9	1	5	1	7	16	8	16	8	32	0	8	0	10	18	2	0	3	4	9	59	75

SIZE JUN 11-20	EASTERN FORESTS AND GROUPS									WESTERN FORESTS AND GROUPS														
	BEA	CUS	GAL	SE	DEE	HEL	LEW	NE	EAST	BIT	CLE	NEZ	SW	CAB	LOL	FLA	KOO	NO	COE	COL	KAN	STJ	NW	WEST	REGION
1	0	0	0	0	0	67	100	75	50	100	100	75	90	0	80	100	100	86	0	100	100	0	100	90	81
2	0	100	0	100	0	33	0	25	50	0	0	0	0	0	20	0	0	14	0	0	0	0	0	5	15
3	0	0	0	0	0	0	0	0	0	0	0	25	10	0	0	0	0	0	0	0	0	0	0	5	4
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	2	0	2	0	3	1	4	6	5	1	4	10	0	5	1	1	7	0	1	2	0	3	20	26

SIZE JUN 21-30	EASTERN FORESTS AND GROUPS									WESTERN FORESTS AND GROUPS														
	BEA	CUS	GAL	SE	DEE	HEL	LEW	NE	EAST	BIT	CLE	NEZ	SW	CAB	LOL	FLA	KOO	NO	COE	COL	KAN	STJ	NW	WEST	REGION
1	100	28	100	46	100	88	100	93	64	91	92	94	93	0	88	50	81	83	100	88	80	100	89	89	83
2	0	72	0	54	0	13	0	7	36	9	8	3	5	0	12	0	19	15	0	13	20	0	11	10	16
3	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	50	0	3	0	0	0	0	0	2	1
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2	18	4	29	5	8	2	15	39	11	12	33	56	0	17	2	21	40	1	16	10	8	35	131	170

SIZE JUL 1-10	EASTERN FORESTS AND GROUPS									WESTERN FORESTS AND GROUPS														
	BEA	CUS	GAL	SE	DEE	HEL	LEW	NE	EAST	BIT	CLE	NEZ	SW	CAB	LOL	FLA	KOO	NO	COE	COL	KAN	STJ	NW	WEST	REGION
1	100	33	100	60	75	73	67	72	68	95	80	88	88	0	81	80	82	81	78	50	91	96	85	85	82
2	0	56	0	33	13	27	33	24	26	5	20	10	10	0	19	20	18	19	22	38	9	4	13	14	16
3	0	11	0	7	13	0	0	4	5	0	0	2	1	0	0	0	0	0	0	13	0	0	2	1	2
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix Table A-7. WTDSAM

FIRE OCCURRENCE BY COVER TYPE, CLASSIFIED AREAS, REGION 1. 1950-1973
EACH AMOUNT REPRESENTS A 24-YEAR TOTAL

AREA CODE NUMBER AND NAME	DOUG F-LAR	G-FIR	PPINE	SUBAL	WPINE	LPOLE	ENGLE	CO-HL	D-B-G	TOTAL
10 NON-WILDERNESS	3345	1270	2320	4709	1300	906	2096	887	1170	1520	19523
CATEGORY SUBTOTAL	3345	1270	2320	4709	1300	906	2096	887	1170	1520	19523
1 ANACONDA PINTLAR WILDERNESS A	9	0	0	1	32	1	18	3	0	1	65
2 BOB MARSHALL WILDERNESS AREA	40	11	8	9	75	6	49	30	0	11	239
3 CABINET WILDERNESS AREA	7	1	6	2	19	3	3	9	0	13	63
4 GATES OF THE MOUNTIANS WILDER	4	0	0	19	0	0	2	1	1	2	29
5 SCAPEGOAT WILDERNESS AREA	10	0	1	1	18	0	10	5	0	0	45
6 SELWAY BITTERROOT WILDERNESS	249	21	97	274	335	7	226	115	15	207	1546
20 ABSAROKA PRIMITIVE AREA	1	0	0	0	1	0	2	3	0	0	7
21 SPANISH PEAKS PRIMITIVE AREA	2	0	0	0	2	0	5	0	0	0	9
22 MEANTOOTH PRIMITIVE AREA	1	0	0	0	3	0	3	1	0	0	8
23 MISSIONS PRIMITIVE AREA	3	2	2	0	25	0	4	5	0	2	43
24 SALMON RIVER BREAKS PRIMITIVE	42	0	9	98	57	1	31	14	0	6	258
CATEGORY SUBTOTAL	368	35	123	404	567	18	353	186	16	242	2312
50 WEST BIG HOLE (NSA)	0	0	0	0	3	0	1	0	0	0	4
51 ITALIAN PEAK (NSA)	1	0	0	0	0	0	0	0	0	0	1
53 BARO MOUNTIAN (NSA)	3	0	0	0	3	0	3	1	0	0	10
54 MAUMICE MOUNTIAN (NSA)	1	0	0	0	0	0	2	0	0	0	3
55 LAKE PLATEAU (NSA)	0	0	0	0	1	0	1	1	0	0	3
56 FISHTAIL PLATEAU (NSA)	0	0	0	0	2	0	0	0	0	0	2
57 SADDLE BACK MOUNTIAN (NSA)	0	0	0	0	1	0	1	0	0	0	2
58 HELL ROARING RED LODGE CREEK	0	0	0	0	1	0	1	0	0	0	2
61 FLINT RANGE (NSA)	0	0	0	0	3	0	3	1	0	0	7
63 MIDDLE FORK CONTINENTAL DIVID	4	6	4	0	33	1	3	5	0	21	77
64 SWAN RUNNER (NSA)	2	1	2	0	13	0	1	3	0	0	22
65 TOBACCO (NSA)	1	0	0	0	4	0	1	1	0	0	7
66 THOMPSON SPION (NSA)	0	0	2	0	3	0	0	1	0	4	10
67 HILGARD (NSA)	3	0	0	0	2	0	0	0	0	3	8
68 HYALITE (NSA)	0	0	0	0	1	0	0	0	0	0	1
69 NORTH ABSAROKA (NSA)	10	0	0	0	7	0	7	1	0	0	25
70 LION HEAD (NSA)	1	0	0	0	0	0	0	0	0	0	1
71 HELL ROARING BUFFALO FORK (NSA	2	0	0	0	2	0	0	0	0	0	4
72 ABUNDANCE WOLVERINE LOST CREE	1	0	0	0	3	0	1	1	0	0	6
74 ROCK ISLAND (NSA)	0	0	0	0	0	0	1	0	0	0	1
76 SILVER KING FALLS CREEK (NSA)	1	0	0	0	3	1	1	0	0	0	6
77 ARRASTRA STONEWALL (NSA)	1	0	0	0	8	0	1	0	0	0	10
78 GATES OF THE MOUNTIANS (NSA)	4	0	0	12	0	0	3	0	0	2	21
79 ROCK MOUNTIAN FACE CONTINENTA	1	0	0	0	2	0	1	0	0	0	4
80 RENSHAW MOUNTIAN (NSA)	5	0	0	0	1	0	0	0	0	0	6
81 DEER CREEK (NSA)	1	0	0	0	0	0	0	0	0	0	1
82 SWAN MORTUNE WEST SIDE (NSA)	17	4	2	3	29	0	12	7	0	2	76
										6	74

WASTE NOT © BONE

Appendix Table A-8. WLODSAM

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1956-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 6
SELWAY BITTERROOT WILDERNESS AREA
AREA=1240516 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
56	24	3	0	0	0	27	4
51	70	7	0	0	0	77	4
52	44	10	0	0	0	54	11
53	90	51	4	0	1	146	828
54	35	5	0	0	0	40	0
55	13	6	1	0	0	20	43
56	35	4	1	1	0	41	224
57	45	13	0	0	0	58	9
58	66	7	0	0	0	73	6
59	46	9	2	0	0	57	42
60	15	9	0	0	0	24	9
61	197	44	3	0	3	247	4526
62	34	6	3	0	0	43	116
63	104	15	3	0	0	122	131
64	21	6	0	0	0	27	8
65	47	4	0	0	0	51	5
66	68	15	1	0	0	84	32
67	58	25	5	0	3	91	5541
68	14	2	0	0	0	16	5
69	18	6	1	0	0	25	28
70	60	6	0	0	0	66	0
71	44	8	1	0	0	53	20
72	40	11	0	0	0	51	11
73	42	9	0	1	2	53	3051
TOT	1230	281	25	2	9	1546	14365
AVE	51.25	11.71	1.04	.08	.38	64.42	599.
PCT	79.56	18.18	1.62	.13	.58		
PCT	100.00	20.44	2.26	.65	.58		

FIRES PER MILLION ACRES PER YEAR 51.92
AREA BURNED 482.45

Appendix Table B-1
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. RI. 1956-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 1
ANACONDA PINTLAR WILDERNESS AREA
AREA= 157803 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
53	1	0	0	0	0	1	0
54	0	1	0	0	0	1	0
55	2	0	0	0	0	2	0
56	4	2	0	0	0	6	2
57	1	1	0	0	0	2	1
58	2	0	0	0	0	2	0
59	2	2	0	0	0	4	0
60	2	1	0	0	0	3	0
61	5	1	0	0	0	6	2
63	2	0	0	0	0	2	0
65	2	0	0	0	0	2	0
66	6	1	0	0	0	7	3
67	3	2	0	0	0	5	3
68	3	0	0	0	0	3	0
69	7	1	0	0	0	8	1
70	4	0	0	0	0	4	0
71	2	2	0	0	0	4	0
72	1	0	0	0	0	1	0
73	1	1	0	0	0	2	7
TOT	50	15	0	0	0	65	19
AVE	2.08	.63	0.00	0.00	0.00	2.71	1.
PCT	76.92	23.08	0.00	0.00	0.00		
PCT	100.00	23.08	0.00	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 17.16
AREA BURNED 5.02

Appendix Table B-2
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, FI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 2
BOB MARSHALL WILDERNESS AREA
AREA= 950000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
50	2	0	0	0	0	2	0
51	4	1	0	0	0	5	0
52	3	0	0	0	0	3	0
53	8	3	2	2	0	15	422
54	5	0	0	0	0	5	0
55	6	0	0	0	0	6	0
56	6	0	0	0	0	6	0
57	15	0	0	0	0	15	0
58	3	0	0	0	0	3	0
59	5	4	1	0	0	10	40
60	15	3	0	0	0	18	6
61	18	3	0	0	0	21	2
62	13	1	0	0	0	14	0
63	17	0	0	0	0	17	0
64	5	1	0	0	0	6	0
65	3	0	0	0	0	3	0
66	4	2	0	0	0	6	5
67	12	5	0	0	0	17	12
68	2	0	0	0	0	2	0
69	12	2	0	1	0	15	284
70	6	1	0	0	0	7	0
71	11	3	0	0	0	14	0
72	2	0	0	0	0	2	0
73	23	4	0	0	0	27	20
TOT	200	33	3	3	0	239	791
AVE	8.33	1.38	.13	.13	0.00	9.96	33.
PCT	83.68	13.81	1.26	1.26	0.00		
PCT	100.00	16.32	2.51	1.26	0.00		

FIRES PER MILLION ACRES PER YEAR 10.48
AREA BURNED 34.69

Appendix Table B-3

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS. R1. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 3
CABINET WILDERNESS AREA
AREA= 94672 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
51	1	1	0	0	0	2	2
52	4	3	0	0	0	7	6
53	8	12	1	0	0	21	68
54	3	0	0	0	0	3	0
56	1	0	0	0	0	1	0
57	2	0	0	0	0	2	0
58	1	0	0	0	0	1	0
60	2	0	0	0	0	2	0
61	5	4	0	0	0	9	3
63	2	0	0	0	0	2	0
64	1	0	0	0	0	1	0
66	0	1	0	0	0	1	1
67	4	2	0	0	1	7	672
70	2	0	0	0	0	2	0
71	1	0	0	0	0	1	0
73	1	0	0	0	0	1	0
TOT	38	23	1	0	1	63	752
AVE	1.58	.96	.04	0.00	.04	2.63	31.
PCT	60.32	36.51	1.59	0.00	1.59		
PCT	100.00	39.68	3.17	1.59	1.59		

FIRES PER MILLION ACRES PER YEAR 27.84
AREA BURNED 332.37

Appendix Table B-4
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 4
GATES OF THE MOUNTIANS WILDERNESS AREA
AREA= 28562 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
50	2	1	0	0	0	3	0
51	1	0	0	0	0	1	0
52	1	0	0	0	0	1	0
54	0	1	0	0	0	1	7
57	0	1	0	0	0	1	2
60	1	1	1	0	0	3	87
61	1	0	1	0	0	2	37
62	0	1	0	0	0	1	2
63	1	0	0	0	0	1	0
64	1	1	1	0	0	3	14
66	1	0	0	0	0	1	0
67	1	1	0	0	0	2	2
68	1	0	0	0	0	1	0
69	0	1	0	0	0	1	1
70	0	1	0	0	0	1	0
71	1	2	0	0	0	3	0
72	1	1	0	0	0	2	0
73	1	0	0	0	0	1	0
TOT	14	12	3	0	0	29	162
AVE	.58	.50	.13	0.00	0.00	1.21	6.
PCT	48.28	41.38	10.34	0.00	0.00		
PCT	100.00	51.72	10.34	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 42.31
AREA BURNED 221.74

Appendix Table B-5

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. R1. 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 5
SCAPEGOAT WILDERNESS AREA
AREA= 239205 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
51	1	0	0	0	0	1	0
53	1	0	0	0	0	1	0
55	1	0	0	1	0	2	170
57	1	0	0	0	0	1	0
58	1	0	0	0	0	1	0
59	1	0	0	0	0	1	0
60	5	0	0	0	0	5	0
61	4	3	0	0	0	7	1
62	1	2	0	0	0	3	0
63	3	3	0	0	0	6	4
64	1	0	0	0	0	1	0
65	2	0	0	0	0	2	0
67	2	0	0	0	0	2	0
68	1	0	0	0	0	1	0
71	5	0	0	0	0	5	0
73	6	0	0	0	0	6	0
TOT	36	8	0	1	0	45	175
AVE	1.50	.33	0.00	.04	0.00	1.88	7.
PCT	80.00	17.78	0.00	2.22	0.00		
PCT	100.00	20.00	2.22	2.22	0.00		

FIRES PER MILLION ACRES PER YEAR 7.84
AREA BURNED 30.47

Appendix Table B-6

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, MT. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 20

ABSAROKA PRIMITIVE AREA
AREA= 64000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
53	0	0	0	0	1	1	.1007	
56	2	0	0	0	0	2	0	
62	1	0	0	0	0	1	0	
66	1	0	0	0	0	1	0	
67	1	0	0	0	0	1	0	
73	1	0	0	0	0	1	0	
TOT	6	0	0	0	1	7	.1007	
AVE	.25	0.00	0.00	0.00	.04	.29		42.
PCT	85.71	0.00	0.00	0.00	14.29			
PCT	100.00	14.29	14.29	14.29	14.29			

FIRES PER MILLION ACRES PER YEAR 4.56
AREA BURNED 655.50

Appendix Table B-7
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 21
SPANISH PEAKS PRIMITIVE AREA
AREA= 50516 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
52	1	0	0	0	0	1	0	
54	1	0	0	0	0	1	0	
55	1	1	0	0	0	2	3	
61	1	0	0	0	0	1	0	
63	0	1	0	0	0	1	2	
70	1	0	0	0	0	1	0	
71	0	1	0	0	0	1	0	
72	1	0	0	0	0	1	0	
TOT	6	3	0	0	0	9	5	
AVE	.25	.13	0.00	0.00	0.00	.38	0.	
PCT	66.67	33.33	0.00	0.00	0.00			
PCT	100.00	33.33	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 7.42
AREA BURNED 4.12

Appendix Table B-8

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 22
BEARTOOTH PRIMITIVE AREA
AREA= 230000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
53	0	1	0	0	0	1	4	
56	1	0	0	0	0	1	0	
60	1	0	0	0	0	1	0	
61	1	0	0	0	0	1	0	
62	1	0	0	0	0	1	0	
64	1	0	0	0	0	1	0	
67	1	0	0	0	0	1	0	
72	1	0	0	0	0	1	0	
TOT	7	1	0	0	0	8	4	
AVE	.29	.04	0.00	0.00	0.00	.33	0.	
PCT	87.50	12.50	0.00	0.00	0.00			
PCT	100.00	12.50	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 1.45
AREA BURNED .72

Appendix Table B-9

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. FI. 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 23
MISSIONS PRIMITIVE AREA
AREA= 73945 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
53	3	3	1	0	0	7	86
55	2	1	0	0	0	3	0
56	1	0	0	0	0	1	0
57	1	0	0	0	0	1	0
60	1	1	0	0	0	2	4
61	2	0	0	0	0	2	0
62	0	1	0	0	0	1	0
63	1	0	0	0	0	1	0
67	4	0	0	0	0	4	0
68	2	0	0	0	0	2	0
69	2	0	0	0	0	2	0
70	3	1	0	0	0	4	0
72	4	2	0	0	0	6	2
73	7	0	0	0	0	7	0
TOT	33	9	1	0	0	43	92
AVE	1.38	.38	.04	0.00	0.00	1.79	4.
PCT	76.74	20.93	2.33	0.00	0.00		
PCT	100.00	23.26	2.33	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 24.23
AREA BURNED 51.34

Appendix Table B-10
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 24
SALMON RIVER BREAKS PRIMITIVE AREA
AREA= 216570 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
50	5	1	0	0	0	6	0
51	3	0	0	0	0	3	0
52	3	0	0	0	0	3	0
53	8	3	1	0	0	12	34
54	6	0	0	0	0	6	0
56	1	1	0	0	0	2	1
57	3	1	0	0	0	4	2
58	1	1	0	0	0	2	0
59	0	1	0	0	0	1	0
60	7	5	0	0	0	12	15
61	12	3	2	0	1	18	658
62	8	2	0	0	1	11	1769
63	8	1	1	0	0	10	35
64	9	1	0	0	0	10	1
65	10	2	0	0	0	12	1
66	12	10	2	0	0	24	151
67	26	6	1	0	0	35	17
68	7	6	1	0	0	14	47
69	2	1	0	0	0	3	1
70	16	4	0	0	0	20	0
71	7	1	0	0	0	8	0
72	25	3	1	0	0	29	18
73	10	2	1	0	0	13	13
TOT	189	57	13	0	2	258	2963
AVE	7.88	2.38	.42	0.00	.08	10.75	123.
PCT	73.26	22.09	5.04	0.00	.78		
PCT	100.00	26.74	4.65	.78	.78		

FIRES PER MILLION ACRES PER YEAR 49.57
AREA BURNED 569.27

Appendix Table B-11
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. RI. 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 50
WEST BIG HOLE (USA)
AREA= 38359 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
56	1	0	0	0	0	1	0	
62	2	0	0	0	0	2	0	
71	1	0	0	0	0	1	0	
TOT	4	0	0	0	0	4	0	
AVE	.17	0.00	0.00	0.00	0.00	.17	0.	
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 4.34
AREA BURNED 0.00

Appendix Table B-12
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 51
ITALIAN PEAK (NSA)
AREA= 9800 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
55	1	0	0	0	0	1	0	
TOT	1	0	0	0	0	1	0	
AVE	.04	0.00	0.00	0.00	0.00		.04	0.
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 4.25
AREA BURNED 0.00

Appendix Table B-13

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 53
BARB MOUNTIAN (NSA)
AREA= 52000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
56	1	0	0	0	0	1	0
60	0	1	0	0	0	1	1
61	1	0	0	0	0	1	0
63	2	0	0	0	0	2	0
68	1	0	0	0	0	1	0
69	1	0	0	0	0	1	0
70	0	1	0	0	0	1	0
73	2	0	0	0	0	2	0
TOT	8	2	0	0	0	10	1
AVE	.33	.08	0.00	0.00	0.00	.42	0.
PCT	80.00	20.00	0.00	0.00	0.00		
PCT	100.00	20.00	0.00	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 8.01
AREA BURNED .80

Appendix Table B-14
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS. MI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 54
MAURICE MOUNTIAN (NSA)
AREA= 36625 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
52	1	0	0	0	0	1	0	
57	1	0	0	0	0	1	0	
62	1	0	0	0	0	1	0	
TOT	3	0	0	0	0	3	0	
AVE	.13	0.00	0.00	0.00	0.00	.13	0.	
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 3.41
AREA BURNED 0.00

Appendix Table B-15

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. RI. 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 55
LAKE PLATEAU (NSA)
AREA= 77365 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
62	1	0	0	0	0	1	0
69	0	1	0	0	0	1	2
70	0	0	1	0	0	1	31
TOT	1	1	1	0	0	3	33
AVE	.04	.04	.04	0.00	0.00	.13	1.
PCT	33.33	33.33	33.33	0.00	0.00		
PCT	100.00	66.67	33.33	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 1.62
AREA BURNED 17.77

Appendix Table B-16
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 56
FISHTAIL PLATEAU (NSA)
AREA= 24175 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
54	1	0	0	0	0	1	0
67	1	0	0	0	0	1	0
TOT	2	0	0	0	0	2	0
AVE	.08	0.00	0.00	0.00	0.00	.08	0.
PCT	100.00	0.00	0.00	0.00	0.00		
PCT	100.00	0.00	0.00	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 3.45
AREA BURNED 0.00

Appendix Table B-17

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 57
SADDLE BACK MOUNTIAN (NSA)
AREA= 11396 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
55	0	1	0	0	0	1	0	
61	0	0	0	1	0	1	180	
TOT	0	1	0	1	0	2	180	
AVE	0.00	.04	0.00	.04	0.00		.08	8.
PCT	0.00	50.00	0.00	50.00	0.00			
PCT	100.00	100.00	50.00	50.00	0.00			

FIRES PER MILLION ACRES PER YEAR 7.37
AREA BURNED 663.36

Appendix Table B-18
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 58
HELL ROARING RED LODGE CREEK (NSA)
AREA= 42002 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
60	2	0	0	0	0	2	0	
TOT	2	0	0	0	0	2	0	
AVE	.08	0.00	0.00	0.00	0.00	.08		0.
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 1.98
AREA BURNED 0.00

Appendix Table B-19
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, PI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 61
FLINT RANGE (NSA)
AREA= 35266 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
53	0	1	0	1	0	2	171
56	1	0	0	0	0	1	0
57	1	0	0	0	0	1	0
60	0	0	1	0	0	1	52
67	0	0	1	0	0	1	60
70	1	0	0	0	0	1	0
TOT	3	1	2	1	0	7	283
AVE	.13	.04	.09	.04	0.00	.29	12.
PCT	42.86	14.29	28.57	14.29	0.00		
PCT	100.00	57.14	42.86	14.29	0.00		

FIRES PER MILLION ACRES PER YEAR 8.27
AREA BURNED 334.34

Appendix Table B-20
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 63
MIDDLE FORK CONTINENTAL DIVIDE (NSA)
AREA= 30270n ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
50	2	0	0	0	0	2	0	
51	2	0	0	0	0	2	0	
52	2	0	0	0	0	2	0	
53	7	1	0	0	0	8	2	
54	1	1	0	0	0	2	0	
55	1	0	0	0	0	1	0	
57	5	0	0	0	0	5	0	
58	3	1	0	0	0	4	0	
59	2	2	0	0	0	4	2	
60	4	1	0	0	0	5	6	
61	3	0	0	0	0	3	0	
62	9	2	0	0	0	11	5	
63	6	1	0	0	0	7	0	
65	2	0	0	0	0	2	0	
69	6	0	0	0	0	6	0	
70	1	0	0	0	0	1	0	
71	1	1	0	0	0	2	0	
72	2	0	0	0	0	2	0	
73	6	2	0	0	0	8	0	
TOT	65	12	0	0	0	77	15	
AVE	2.71	.50	0.00	0.00	0.00	3.21	1.	
PCT	84.42	15.58	0.00	0.00	0.00			
PCT	100.00	15.58	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 10.60
AREA BURNED 2.06

Appendix Table B-21

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 64
SWAN BUNKER (NSA)
AREA= 60000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
53	1	1	0	0	0	2	8
58	1	0	0	0	0	1	0
59	1	0	0	0	0	1	0
60	1	0	0	0	0	1	0
61	1	0	0	0	0	1	0
62	3	0	0	0	0	3	0
63	3	0	0	0	0	3	0
66	4	0	0	0	0	4	0
69	2	0	0	0	0	2	0
73	2	0	2	0	0	4	75
TOT	19	1	2	0	0	22	83
AVE	.79	.04	.08	0.00	0.00	.92	3.
PCT	86.36	4.55	9.09	0.00	0.00		
PCT	100.00	13.64	9.09	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 15.28
AREA BURNED 57.64

Appendix Table B-22
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 65
TUCHUCK (NSA)
AREA= 20640 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
51	1	0	0	0	0	1	0	
58	1	0	0	0	0	1	0	
61	1	0	0	0	0	1	0	
62	1	0	0	0	0	1	0	
63	2	0	0	0	0	2	0	
70	1	0	0	0	0	1	0	
TOT	7	0	0	0	0	7	0	
AVE	.29	0.00	0.00	0.00	0.00	.29	0.	
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 14.13
AREA BURNED 0.00

Appendix Table B-23
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 66
THOMPSON SETON (NSA)
AREA= 24200 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
58	0	0	0	0	1	1	1004	
62	1	0	0	0	0	1	0	
67	2	1	0	0	0	3	0	
69	1	1	0	0	0	2	1	
70	2	0	0	0	0	2	0	
73	1	0	0	0	0	1	0	
TOT	7	2	0	0	1	10	1005	
AVE	.29	.08	0.00	0.00	.04	.42	42.	
PCT	70.00	20.00	0.00	0.00	10.00			
PCT	100.00	30.00	10.00	10.00	10.00			

FIRES PER MILLION ACRES PER YEAR 17.22
AREA BURNED 1730.37

Appendix Table B-24

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 67
HILGARD (NSA)
AREA= 79000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
53	2	0	0	0	0	2	0	
54	1	0	0	0	0	1	0	
57	1	0	0	0	0	1	0	
58	2	0	0	0	0	2	0	
60	1	0	0	0	0	1	0	
71	1	0	0	0	0	1	0	
TOT	8	0	0	0	0	8	0	
AVE	.33	0.00	0.00	0.00	0.00		.33	0.
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 4.22
AREA BURNED 0.00

Appendix Table B-25

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 68
HYALITE (NDA)
AREA= 22268 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
56	0	0	1	0	0	1	20	
TOT	0	0	1	0	0	1	20	
AVE	0.00	0.00	.04	0.00	0.00	.04		1.
PCT	0.00	0.00	100.00	0.00	0.00			
PCT	100.00	100.00	100.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 1.87
AREA BURNED 37.42

Appendix Table B-26

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 59
NORTH ABSAROKA (NSA)
AREA= 221044 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
50	0	0	0	1	0	1	100
52	1	0	0	0	0	1	0
56	2	0	0	0	0	2	0
60	2	0	0	0	0	2	0
61	3	0	1	0	0	4	80
62	1	0	0	0	0	1	0
63	0	1	0	0	0	1	2
66	0	1	0	0	0	1	0
67	2	1	0	0	0	3	2
70	1	0	0	0	0	1	0
71	0	2	0	0	0	2	0
73	6	0	0	0	0	6	0
TOT	18	5	1	1	0	25	184
AVE	.75	.21	.04	.04	0.00	1.04	8.
PCT	72.00	20.00	4.00	4.00	0.00		
PCT	100.00	28.00	8.00	4.00	0.00		

FIRES PER MILLION ACRES PER YEAR 4.71
AREA BURNED 34.68

Appendix Table B-27
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 70
LION HEAD (USA)
AREA= 18000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
53	1	0	0	0	0	1	0	
TOT	1	0	0	0	0	1	0	
AVE	.04	0.00	0.00	0.00	0.00	.04	0.	
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 2.31
AREA BURNED 0.00

Appendix Table B-28
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 71
HELL ROARING BUFFALO FORK(USA)
AREA= 71000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
61	0	0	1	0	0	1	26	
64	0	1	0	0	0	1	4	
72	2	0	0	0	0	2	0	
TOT	2	1	1	0	0	4	30	
AVE	.08	.04	.04	0.00	0.00	.17	1.	
PCT	50.00	25.00	25.00	0.00	0.00			
PCT	100.00	50.00	25.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 2.33
AREA BURNED 17.46

Appendix Table B-29

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 72
ABUNDANCE WOLVERINE LOST CREEK (USA)
AREA= 20532 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
56	1	0	1	0	0	2	90	
57	1	0	0	0	0	1	0	
60	1	0	0	0	0	1	0	
63	1	0	0	0	0	1	0	
69	1	0	0	0	0	1	0	
TOT	5	0	1	0	0	6	90	
AVE	.21	0.00	.04	0.00	0.00	.25		4.
PCT	83.33	0.00	16.67	0.00	0.00			
PCT	100.00	16.67	16.67	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 12.00
AREA BURNED 180.91

Appendix Table B-30
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 74
ROCK ISLAND (NSA)
AREA= 954 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
70	1	0	0	0	0	1	0	
TOT	1	0	0	0	0	1	0	
AVE	.04	0.00	0.00	0.00	0.00	.04		0.
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 43.86
AREA BURNED 0.00

Appendix Table B-31
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, HI, 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 76
SILVER KING FALLS CREEK (NSA)
AREA= 29700 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
61	0	1	0	0	0	1	0
63	0	1	0	0	0	1	3
67	1	0	0	0	0	1	0
71	1	1	0	0	0	2	0
73	1	0	0	0	0	1	0
TOT	3	3	0	0	0	6	3
AVE	.13	.13	0.00	0.00	0.00	.25	0.
PCT	50.00	50.00	0.00	0.00	0.00		
PCT	100.00	50.00	0.00	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 8.42
AREA BURNED 4.21

Appendix Table B-32
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 77
ARRASTRA STONEWALL (NSA)
AREA= 9400 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
56	1	0	0	0	0	1	0	
58	3	0	0	0	0	3	0	
60	1	0	0	0	0	1	0	
61	1	0	0	0	0	1	0	
67	1	0	0	0	0	1	0	
71	1	0	0	0	0	1	0	
73	1	1	0	0	0	2	0	
TOT	9	1	0	0	0	10	0	
AVE	.38	.04	0.00	0.00	0.00	.42	0.	
PCT	90.00	10.00	0.00	0.00	0.00			
PCT	100.00	10.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 44.33
AREA BURNED 0.00

Appendix Table B-33
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. PI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 78
GATES OF THE MOUNTIANS (NSA)
AREA= 6000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
52	0	1	0	0	0	1	0
53	1	1	0	0	0	2	0
56	3	1	0	0	0	4	8
57	0	1	0	0	0	1	0
60	0	1	0	0	0	1	4
61	1	1	0	0	0	2	3
63	1	1	0	0	0	2	3
65	0	1	0	0	0	1	1
67	3	1	0	0	0	4	1
70	0	1	0	0	0	1	0
72	0	1	0	0	0	1	0
73	1	0	0	0	0	1	0
TOT	10	11	0	0	0	21	20
AVE	.42	.45	0.00	0.00	0.00	.88	1.
PCT	47.62	52.38	0.00	0.00	0.00		
PCT	100.00	52.38	0.00	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 145.83
AREA BURNED 138.89

Appendix Table B-34

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 79
ROCK MOUNTIAN FACE CONTINENTAL DIVIDE (NSA)
AREA= 62100 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
55	1	1	0	0	0	2	1	
67	0	1	0	0	0	1	2	
70	1	0	0	0	0	1	0	
TOT	2	2	0	0	0	4	3	
AVE	.08	.08	0.00	0.00	0.00		.17	0.
PCT	50.00	50.00	0.00	0.00	0.00			
PCT	100.00	50.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 2.68
AREA BURNED 2.01

Appendix Table B-35

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. RI. 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 80
RENSHAW MOUNTIAN (NSA)
AREA= 26100 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
55	0	1	0	1	0	2	0	
61	1	0	0	0	0	1	0	
67	1	0	0	0	0	1	0	
69	1	0	0	0	0	1	0	
71	1	0	0	0	0	1	0	
TOT	4	1	0	1	0	6	0	
AVE	.17	.04	0.00	.04	0.00	.25	0.	
PCT	66.67	16.67	0.00	16.67	0.00			
PCT	100.00	33.33	16.67	16.67	0.00			

FIRES PER MILLION ACRES PER YEAR 9.58
AREA BURNED 0.00

Appendix Table B-36
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 81
DEEP CREEK (NSA)
AREA= 28900 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
53	0	0	1	0	0	1	40	
TOT	0	0	1	0	0	1	40	
AVE	0.00	0.00	.04	0.00	0.00	.04		2.
PCT	0.00	0.00	100.00	0.00	0.00			
PCT	100.00	100.00	100.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 1.44
AREA BURNED 57.67

Appendix Table B-37
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, FI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 82
SWAN MONTUPE WEST SIDE (NSA)
AREA= 107491 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
51	1	0	0	0	0	1	0
52	0	0	1	0	0	1	16
54	1	0	0	0	0	1	0
55	0	3	1	0	0	4	35
56	2	0	0	0	0	2	0
57	4	0	0	0	0	4	0
60	4	0	0	0	0	4	0
61	10	0	0	0	0	10	0
62	3	2	0	0	0	5	1
63	4	0	0	0	0	4	0
64	1	0	0	0	0	1	0
65	1	0	0	0	0	1	0
66	1	0	0	0	0	1	0
67	7	1	0	0	0	8	2
68	4	0	0	0	0	4	0
69	7	0	0	0	0	7	0
70	1	0	0	0	0	1	0
71	4	0	0	0	0	4	0
72	2	0	0	0	0	2	0
73	6	5	0	0	0	11	4
TOT	53	11	2	0	0	76	58
AVE	2.63	.46	.08	0.00	0.00	3.17	2.
PCT	82.89	14.47	2.63	0.00	0.00		
PCT	100.00	17.11	2.63	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 29.46
AREA BURNED 22.48

Appendix Table B-38
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, HI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 83
HOODOO (NSA)
AREA= 157534 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
51	2	0	0	0	0	2	0
52	1	0	0	0	0	1	0
53	5	0	0	0	0	5	0
54	1	0	0	0	0	1	0
55	1	0	0	0	0	1	0
56	1	0	0	0	0	1	0
58	2	0	0	0	0	2	0
59	1	0	0	0	0	1	0
60	4	1	0	0	0	5	3
61	5	1	1	1	0	8	247
62	5	5	0	0	0	10	7
63	3	0	0	0	0	3	0
64	0	1	0	0	0	1	0
65	1	0	0	0	0	1	0
66	2	2	0	0	0	4	6
67	7	0	1	0	0	8	20
68	4	0	0	0	0	4	0
70	6	0	0	0	0	6	0
71	1	0	0	0	0	1	0
72	3	1	0	0	0	4	3
73	3	2	0	0	0	5	2
TOT	58	13	2	1	0	74	288
AVE	2.42	.54	.08	.04	0.00	3.08	12.
PCT	78.38	17.57	2.70	1.35	0.00		
PCT	100.00	21.62	4.05	1.35	0.00		

FIRES PER MILLION ACRES PER YEAR 19.57
AREA BURNED 76.17

Appendix Table B-39
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 84
SCOTCHMAN PEAK (NSA)
AREA= 37020 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
53	0	1	1	0	0	2	13
58	1	0	0	0	0	1	0
61	2	0	0	0	0	2	0
62	2	0	0	0	0	2	0
65	1	0	0	0	0	1	0
70	2	0	0	0	0	2	0
71	3	0	0	0	0	3	0
72	1	0	0	0	0	1	0
73	1	0	1	0	0	2	33
TOT	13	1	2	0	0	16	46
AVE	.54	.04	.08	0.00	0.00	.67	2.
PCT	81.25	6.25	12.50	0.00	0.00		
PCT	100.00	18.75	12.50	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 18.01
AREA BURNED 51.77

Appendix Table B-40
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI. 195?-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 65
LITTLE CLEARWATER RIVER (USA)
AREA= 66600 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
51	3	1	0	0	0	4	0	
52	1	0	0	0	0	1	0	
53	1	0	0	0	0	1	0	
54	3	0	0	0	0	3	0	
55	2	1	2	0	0	5	31	
56	2	0	0	0	0	2	0	
58	2	0	0	0	0	2	0	
59	1	0	0	0	0	1	0	
61	4	3	1	0	0	8	29	
63	4	0	0	0	0	4	0	
66	7	0	2	0	0	9	67	
67	4	0	0	0	0	4	0	
69	3	0	0	0	0	3	0	
70	2	0	0	0	0	2	0	
71	2	0	0	0	0	2	0	
72	10	0	0	0	0	10	0	
73	12	2	0	0	0	14	1	
TOT	63	7	5	0	0	75	128	
AVE	2.63	.29	.21	0.00	0.00	3.13	5.	
PCT	84.00	9.33	6.67	0.00	0.00			
PCT	100.00	10.00	6.67	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 46.92
AREA BURNED 80.08

Appendix Table B-41

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 86
HELLS HALF ACRE (NSA)
AREA= 71700 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
50	2	0	0	0	0	2	0
51	2	1	0	0	0	3	3
52	1	1	0	0	0	2	0
53	2	1	0	0	0	3	2
54	1	1	0	0	0	2	4
55	1	1	0	0	0	2	2
56	2	0	0	0	0	2	0
57	2	0	0	0	0	2	0
58	6	0	0	0	0	6	0
59	2	0	0	0	0	2	0
60	3	0	0	0	0	3	0
61	6	3	1	0	0	10	24
62	3	1	0	0	0	4	0
63	3	0	0	0	0	3	0
64	2	0	0	0	0	2	0
65	1	0	0	0	0	1	0
66	15	2	0	0	0	17	1
67	5	0	0	0	0	5	0
68	5	1	0	0	0	6	1
69	1	0	0	0	0	1	0
70	4	0	0	0	0	4	0
71	8	0	0	0	0	8	0
72	4	1	0	0	0	5	1
73	5	0	0	0	0	5	0
TOT	86	13	1	0	0	100	38
AVE	3.58	.54	.04	0.00	0.00	4.17	2.
PCT	86.00	13.00	1.00	0.00	0.00		
PCT	100.00	14.00	1.00	0.00	0.00		

FIRES PER MILLION ACRES PER YEAR 58.11
AREA BURNED 22.08

Appendix Table B-42

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS, RI, 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 87
UPPER BARGAMIN (NSA)
AREA= 28000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
51	1	0	0	0	0	1	0	
53	1	0	0	0	0	1	0	
54	1	0	0	0	0	1	0	
55	1	0	0	0	0	1	0	
56	2	0	0	0	0	2	0	
58	2	0	0	0	0	2	0	
61	3	0	0	0	0	3	0	
63	1	0	0	0	0	1	0	
65	2	0	0	0	0	2	0	
66	1	0	0	0	0	1	0	
67	1	0	0	0	0	1	0	
68	1	0	0	0	0	1	0	
71	1	0	0	0	0	1	0	
72	2	0	0	0	0	2	0	
73	1	0	0	0	0	1	0	
TOT	21	0	0	0	0	21	0	
AVE	.88	0.00	0.00	0.00	0.00	.88	0.	
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 30.38
AREA BURNED 0.00

Appendix Table B-43

ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, MT. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 88
MIDDLE BARGAMIN (NSA)
AREA= 12800 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
52	2	0	0	0	0	2	0	
53	1	0	0	0	0	1	0	
54	2	0	0	0	0	2	0	
60	1	0	0	0	0	1	0	
65	1	0	0	0	0	1	0	
69	1	0	0	0	0	1	0	
71	3	0	0	0	0	3	0	
TOT	11	0	0	0	0	11	0	
AVE	.46	0.00	0.00	0.00	0.00	.46	0.	
PCT	100.00	0.00	0.00	0.00	0.00			
PCT	100.00	0.00	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 35.81
AREA BURNED 0.00

Appendix Table B-44
ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 89
UPPER MALLARD CREEK
AREA= 27000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
53	1	1	0	1	0	3	284	
60	0	1	0	0	0	1	1	
61	1	0	0	0	0	1	0	
62	0	1	0	0	0	1	1	
70	1	0	0	0	0	1	0	
72	2	0	0	0	0	2	0	
73	1	0	0	0	0	1	0	
TOT	6	3	0	1	0	10	286	
AVE	.25	.13	0.00	.04	0.00	.42		12.
PCT	60.00	30.00	0.00	10.00	0.00			
PCT	100.00	40.00	10.00	10.00	0.00			

FIRES PER MILLION ACRES PER YEAR 15.43
AREA BURNED 441.36

Appendix Table B-45
ANNUAL FIRE LOAD BY SIZE CLASS,
CLASSIFIED AREAS, RI. 1950-73.

ANNUAL FIRE LOAD, WILDERNESS NUMBER 90
HELLS CANYON SEVEN DEVILS (NSA)
AREA= 36000 ACRES

YR	A	B	C	D	E	TOTAL	ACRES
50	0	0	1	0	0	1	15
52	3	0	0	0	0	3	0
54	1	0	0	0	0	1	0
56	0	1	0	0	0	1	1
57	1	0	1	0	0	2	23
58	2	0	0	0	0	2	0
59	1	0	0	0	0	1	0
60	1	0	0	0	0	1	0
63	2	0	0	0	1	3	480
64	2	0	0	0	0	2	0
65	0	3	0	0	0	3	6
66	2	0	0	0	0	2	0
67	6	1	0	0	0	7	1
71	1	0	0	0	0	1	0
72	1	0	0	0	0	1	0
73	1	0	1	0	0	2	30
TOT	24	5	3	0	1	33	556
AVE	1.00	.21	.13	0.00	.04	1.38	23.
PCT	72.73	15.15	9.09	0.00	3.03		
PCT	100.00	27.27	12.12	3.03	3.03		

FIRES PER MILLION ACRES PER YEAR 38.19
AREA BURNED 543.52

Appendix Table B-46

ANNUAL FIRE LOAD BY SIZE CLASS.
CLASSIFIED AREAS. MI, 1950-73.

ANNUAL FIRE LOAD. WILDERNESS NUMBER 91
SALMO-PRIEST (NSA)
AREA= 25900 ACRES

YR	A	B	C	D	E	TOTAL	ACRES	
56	2	0	0	0	0	2	0	
58	9	1	0	0	0	10	0	
60	1	0	0	0	0	1	0	
62	1	0	0	0	0	1	0	
63	1	0	0	0	0	1	0	
67	6	1	0	0	0	7	1	
71	1	0	0	0	0	1	0	
73	5	1	0	0	0	6	4	
TOT	26	3	0	0	0	29	5	
AVE	1.08	.13	0.00	0.00	0.00	1.21	0.	
PCT	89.66	10.34	0.00	0.00	0.00			
PCT	100.00	10.34	0.00	0.00	0.00			

FIRES PER MILLION ACRES PER YEAR 46.65
AREA BURNED 8.04